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Manager and Secretary: E. S. MIDDLETON.

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Our Advertising Competition.

ON Thursday last week the judging took place in connection with our second advertising Competition. On this occasion the judges were:—Mr. J. W. Beauchamp, Director and Secretary of E.D.A.; Mr. W. F. T. Pinkney, of the Newcastle-upon-Tyne Electric Supply Co., Ltd.; and Mr. H. T. Young, of Messrs. Troughton & Young, electrical contractors, Knightsbridge.

In this series the subjects of the advertisements were divided into three classes, namely: Class I, generating plant, switchgear, batteries, and heavy machinery in general; Class II, fittings, switches, lamps, heating and cooking apparatus and general accessories; Class III, instruments, meters, telephones, cables and wires, and miscellaneous apparatus. The results were as follows:—

FOR THE BEST SIX FULL PAGES.

CLASS I.—Prize, £50. Awarded to The British Thomson-Houston Co., Ltd., Rugby, whose advertisements were prepared by Mr. A. L. M. Ayers, manager of the advertisement department.

CLASS II.—Prize, £50. Awarded to The Ormond Engineering Co., Ltd., whose advertisements were prepared by Messrs. Bertram Day & Co., Ltd.

A special award of £25 in this class was made to Messrs. W. T. Henley's Telegraph Works Co., Ltd., for their "ISCO" advertisement.

CLASS III.—Prize, £50. Awarded to The Stella Conduit Co., Ltd., whose advertisements were prepared by Messrs. H. P. Pope, Ltd., of Birmingham.

FOR THE BEST SIX HALF PAGES.

As there were not sufficient entries in each of the three classes, they were all judged as one class.

First Prize, £25. Awarded to The Varley Magnet Company, whose advertisements were prepared by Messrs. E. Walter George, Ltd., of High Holborn, London.

A special award of £15 was made to The Midland Electric Manufacturing Co., Ltd., whose advertisements were prepared by Mr. John F. Preston, of Birmingham.

The report of the Judges will appear in our next issue; in the meantime, the Directors of the ELECTRICAL REVIEW wish to record their grateful thanks to them for the painstaking efficiency with which they carried out the difficult task of deciding the relative merits of so many excellent entries.

The Growth of the Fair.

SOME idea of the remarkable progress that the British Industries Fair has made in the estimation of our manufacturers may be gathered from figures indicating the number of exhibitors in London and Birmingham this year compared with last year's total. At Birmingham the number of exhibits has increased from 400 to 600, while in London the number of firms exhibiting has grown from 600 to 900. The whole of the available space at the White City, London, has been absorbed; it is understood that the number of firms exhibiting would have been larger still but for the limitation of accommodation. At Castle Bromwich, Birmingham, the actual increase in space occupied is larger than the percentage increase in number of exhibitors. There, however, there is practically unlimited site extension accommodation at the disposal of the authorities, and the Birmingham Chamber of Commerce is prepared to add more and more buildings as the popularity of its part of the Fair grows.

It seems certain that the Government Department concerned with the future of the Fair and the Birmingham Chamber will have to consider together this important question of site and space as the Fair reaches the greater place which it seems destined to occupy in relation to our export and Home trade development. Seeing that London has reached its space limit and Birmingham has by no means done so, it might be as well to transfer some of the London trades to Birmingham next year.

Large as the Fair is to-day, the fact remains that approximately 1,500 firms is not an adequate representation considering the vast number of British manufacturing concerns who should be interested in a National Market designed to attract hosts of overseas buyers. The larger the number of firms regularly taking part, the more permanent will be the basis upon which the Fair will be built up; to that end those missing from the present demonstration would assist the authorities in making future plans by intimating their interest at an early date.

Cheapen Electricity!

THE price of electrical energy is one of the most important topics of the time—and one of the most difficult to discuss without going deeply into details. No two areas of supply are alike; local conditions and the past history of an undertaking exercise great influence over the position of affairs to-day, and when we meet with anomalies, as we frequently do, it is unsafe to stigmatise them hastily and without examining the relevant facts. In this respect the supply of electricity differs fundamentally from that of gas and similar commodities, which can be produced at one time, stored, and distributed at another time; the load factor and the nature of the load must be taken into account, and the "average revenue obtained per kWh" is only part of the story.

It is true that the Weir Report, signed in May, 1925, pivoted largely upon the average price charged to consumers for all purposes, which was stated to be (in 1923) 2.047d. for statutory undertakings, relating to rather more than half the total electricity consumed in this country; the remainder probably cost much less, and the true average may have been well under 1.5d. The greatest stress was laid on the estimate that by 1940, under the conditions existing when the Report was drawn up, the average price for public supply would probably not be lower than 1.75d., and certainly not less than 1.5d., and the scheme put forward in the Report was expected to reduce the average price in 1940 (or when the consumption reached 500 kWh per head) to "1d. or under."

The Return of Engineering and Financial Statistics issued by the Electricity Commissioners for the years 1924 and 1925 showed that the revenue from sale of energy of all statutory undertakers in 1923-24 was 1.86d. and in 1924-5 1.75d.—a marked reduction in two years. It will be seen that if this high rate of progress could be maintained, by 1931 the goal aimed at by the Weir Committee of 1d. per kWh would be attained without the help of any new Act or Board. Perhaps we shall have the opportunity to witness the event, for it is generally held that the operations of the Central Electricity Board cannot produce much effect in less than five years. The revenue from power units in 1924-5 averaged 1.07d.

We repeat, then, with increased confidence, the claim that we have previously made that, on the whole, electricity is relatively cheap in this country. The same truth is proclaimed from time to time by those who visit other countries where electricity is supposed to be cheap. Nevertheless, we are far from satisfied with the position. The fact remains that the charges for lighting, and for domestic uses, are often higher than they should be. We would urge electricity supply undertakers to take their courage in both hands and offer their domestic consumers really attractive terms. They will be surprised at the result—but they will have no difficulty in balancing their accounts. They are far too cautious, and wait for the demand to reduce the price instead of reducing the price to increase the demand.

Ductile Tungsten in the United States.

IT will be observed with interest that, according to a recent decision of a United States Court, the Coolidge patent for the production of tungsten wire ductile in the cold state has been declared invalid, on the ground that the ductility is a natural property of the metal and is not patentable. This decision follows that of the House of Lords two years ago, which was based on similar reasoning. Apparently the legal view was that tungsten wire, if it existed, was inherently ductile, and its production was merely the result of normal progress in the art of the metal-worker.

Apart from commercial considerations, our sympathies are with the inventor of the process which made the drawn-wire lamp practicable and effected a great forward step in the history of the incandescent lamp. The injury is aggravated by the fact that the Edison Medal for 1926 was awarded to Dr. Coolidge in December last for the origination of ductile tungsten and the improvement of the X-ray tube, and he has felt obliged to decline that great honour owing to this adverse decision. Whilst we do not question the propriety of his action in this matter, we feel that the fact is regrettable; the distinction was well earned, and it is unfortunate that the award should be nullified merely on the ground of a legal interpretation of the claims of his letters patent. Dr. Coolidge's electrical confrères are well aware of the real value of his work on the tungsten lamp, which is in no way affected by the Court's decision.

Over the Loetschberg on a 4,500-h.p. Locomotive.

Modern electric railway practice, embodying the use of a new Sécheron locomotive employing 12 motors in 6 units, and a new quill spring drive.

By THEODORE RICH.

THERE is a general impression that all the important railways in Switzerland are owned by the Federal Government, whereas there is a considerable mileage of line still owned and operated by private companies; one of the most active of these is the Bernese Alps Railway, which owns the Loetschberg Railway, as well as one route from Berne to Thun, a line from Berne to Neuchatel, and an important link between Legnau and Moutier on the Délémont-Berne line. The Loetschberg tunnel route differs from the St. Gothard and Mont Cenis routes in that it was designed from the start for electrical operation. From Spietz, where the Loetschberg section begins, to Brigue, not far from the entrance to the Simplon tunnel, the distance is 74.4 km. (46.2 miles); the maximum grade is 1 in 37, with an average of 1 in 57 on the north side and 1 in 48 on the south, the altitude reached being 1,242 metres (3,400 ft.). The minimum curvature is 300 metres, 55 per cent. of the line being on curves. The main tunnel has a length of 14.6 km. (about nine miles).

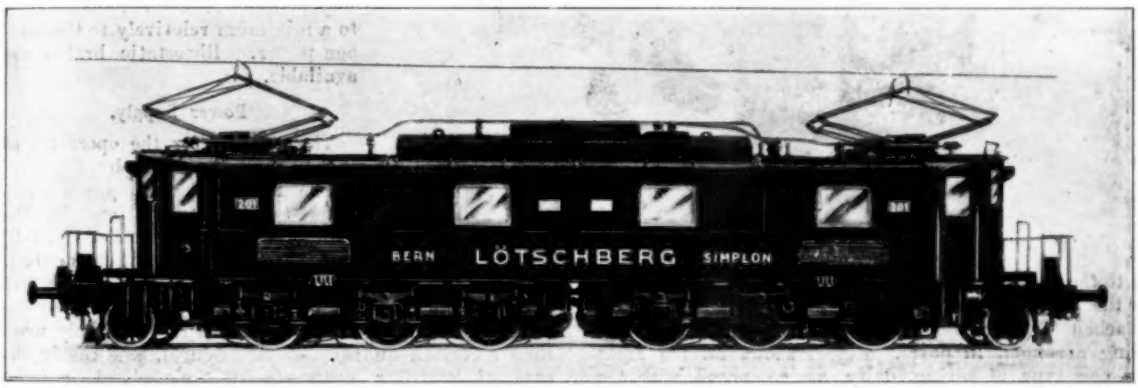


Fig. 1.—A 4,500-h.p. Sécheron Locomotive.

The Sécheron Locomotive.

Until recently the traffic was mainly handled by 2-10-2 locomotives crank-connected to two twin gear-driven dummy shafts, with two single-phase motors of a combined capacity of 2,500 h.p., rated on a 1½-hour basis; these locomotives were designed to haul 300 tons each, three round trips Spietz-Brigue and back in the 24 hours on the standard schedule without overheating. The traffic on the line has been gradually increasing, and instead of using two shorter trains, or one train with two locomotives, it was decided that a material saving in operating costs would come about through the use of a locomotive of a more powerful character; two locomotives were therefore ordered from the Sécheron Company (Société Anonyme des Ateliers de Sécheron) at Geneva, to haul a load of 560 tons up a grade of 1 in 37 at 50 km. (31 miles) per hour. Fig. 1 shows one of the locomotives. It is arranged with six driving axles, and leading and trailing axles, fig. 2.

The total weight is 141.6 metric tons, with an adhesion weight of 114.6 metric tons, or 19 tons per axle. The total length over the buffers is 20.26 metres (66 ft. 5 in.), and the diameter of the driving wheels is 1.35 metres (about 52 inches). The gear reduction is 1 to 5.866. There are 12 motors in pairs, fig. 3, each 375 h.p., giving a combined capacity of 4,500 h.p. at 50 km. per hour at the driving axles on a 1-hour rating, or 3,700 h.p. continuously. The motors in each group are arranged permanently in series. The maximum speed is 75 km. (46.6 miles per hour), although the numerous twists and turns on the line will not allow of such a speed being used in practice.

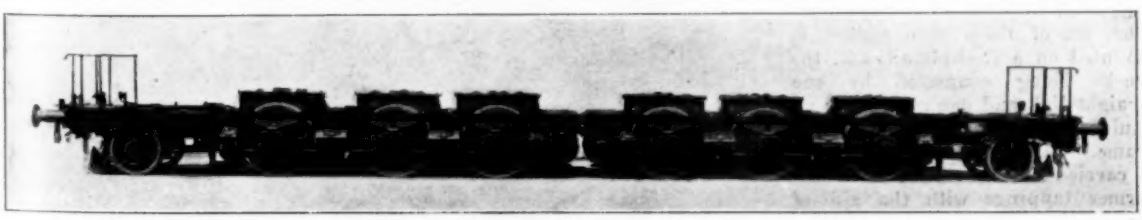


Fig. 2.—The Sécheron Driving Trucks.

Each pair of motors, therefore, has a combined capacity of 750 h.p. Each driving axle has two geared motors driving a quill shaft with a play of 13 mm.,

the movement up and down being allowed for by spiral springs. The Sécheron Company had previously built a number of locomotives for the Swiss Federal Railways with what might be termed tangentially-arranged spiral springs on the Westinghouse system; when it came to the arranging of a similar drive where six axles were concerned, a difficult problem arose in order to get the driving wheels into the space available. A new design was got out and patented by the Sécheron Co. which, instead of driving

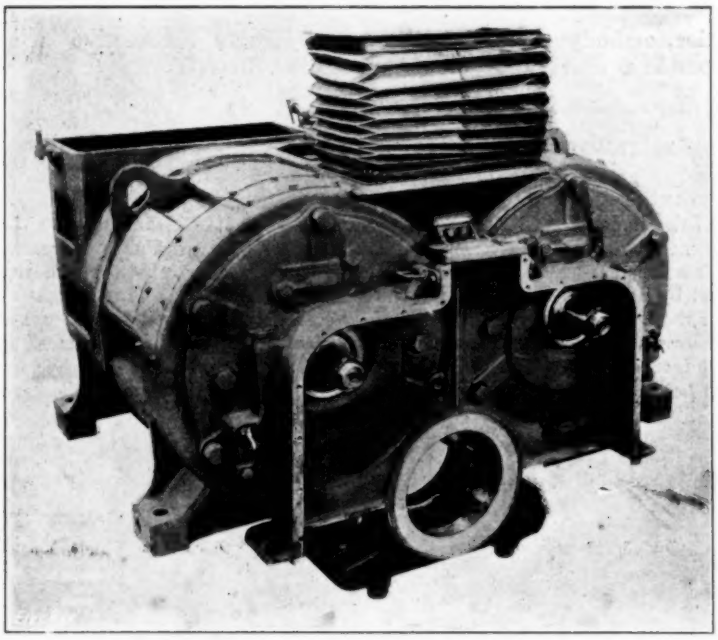


Fig. 3.—Twin-motor Driving Unit, 750 h.p.

on to the spokes with a sort of hand-shaped seat attached to the quill, drives across the spokes on to brackets attached to the inner rim of the wheel, the springs being arranged in pairs. Fig. 4 shows on the right the new type of spring drive as compared with the earlier construction, left. By this means it was possible to use driving wheels of 1,350 mm. (53.2 in.) diameter, thus reducing the unsprung weight by nearly 16 cwt. per axle. The design is such that the number of bolted parts is reduced to a minimum, and the clearance between the quill and axle can be increased. In order to reduce the strain on the springs owing to centrifugal force, they are mounted with an initial stress.

The motors have a series characteristic; they are of the single-phase type operating through a transformer off 15,000 volts at $16\frac{2}{3}$ cycles. Each set of three twin motors is mounted on a steel-plate truck, the trucks being connected by one straight link and one cross link; no haulage strain thus comes on the cab frame. The regulation of the motor is carried out by means of transformer tappings with the aid of pneumatic contactors. With the usual system of pneumatic operation, the air valves are operated by means of solenoids electrically connected to the controller; the Sécheron Co., however, designed a system with some novel features. A cam shaft is run along under the cylinder bases, the cams operating directly on the valve-stalk heads; a slow motion is given to the cam shaft by means of gearing, the shaft running from end to end of the locomotive, so that it can be operated mechanically from either driving position. The contactors are in two banks of 12 each in one long line, one for each group of three driving axles, the sets of cams being, so to speak, in tandem. By this means the wiring of the cab is very greatly simplified; it is claimed that nearly 3,000 metres of contactor circuit is obviated through the mechanical operation of the valves.

By means of an arm on the contactor jaw, the cam shaft is interlocked so that it cannot move further until the contactor has fulfilled its function. By means of an emergency push-button provided at each of the driving platforms, which destroys the equilibrium on both sides of an air-operated piston, the valve-operating cam shaft is shifted sideways so that all the valve tappet heads slip off the cams, thus opening all the contactors simultaneously. The controller is operated by turning a hand wheel which is geared to the cam shaft. Powerful air compressors are fitted to operate the air brakes and pneumatic contactors. In proportion to the power available at the draw-bar, the locomotive, as a single-phase machine, is remarkably light in weight, being only 31.5 kg. (69.3 lb.) per horse power, a figure materially lower than that of most d.c. heavy locomotives; in mountain work it is most important to reduce the dead weight to a minimum relatively to the haulage power. Rheostatic brakes are available.

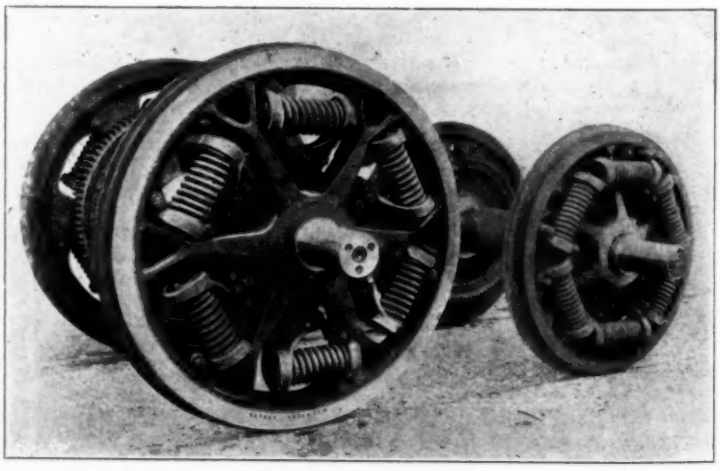


Fig. 4.—Old and New Quill Drives.

Power Supply.

The current for the operation of the line is furnished by the Bernische Kraftwerke Company, which owns two power stations in the Kander Valley, at Spietz (64 m. fall) and Kandergrund (300 metres). Energy is purchased on the basis of a pre-war contract at about 3.5 c. per kWh (about .336d.) (although the power company cannot be called upon to supply more than a certain quantity at this figure), whereas in the case of post-war contracts in Switzerland, a price for traction duty of 7 to 8 c. is more usual. The Spietz station furnishes the current for the section Spietz-Fruitigen, 13.54 km. long, and the Kandergrund station for the remaining 60 km. to Brigue, which is divided into two sections; the two stations are operated in parallel. The generators are wound for 15,000-17,000 volts, $16\frac{2}{3}$ periods, single-phase; they feed the trolley line without any intermediary transformer.

A double feeder, consisting of two bare copper conductors 8 mm. in diameter, runs from end to end of the line. The trolley line is divided up into sections, but linked up at the stations to the feeders by means

of hand-operated oil switches; such operation of these switches as may be required is carried out by the station staff. The contact wires in the goods sidings are fed separately, so that at normal times they can be kept "dead." The maximum circuit breakers at the main feeding points open on to a current-limiting resistance, so that it can be seen whether a short has cleared itself. At each station feeding point a solenoid is placed in the line circuit operating a bell circuit. In the case of a "short," all the solenoids between the fault and the feeding points operate the bell circuits; by finding out which is the furthest bell that has rung, the damaged section can be located.

The trolley wire cross section is 100 sq. mm. along the line, as it acts as an auxiliary feeder; the construction is of the catenary type, with a steel carrier cable of 50 sq. mm. cross section. At these points the supports are of steel lattice work (fig. 5).

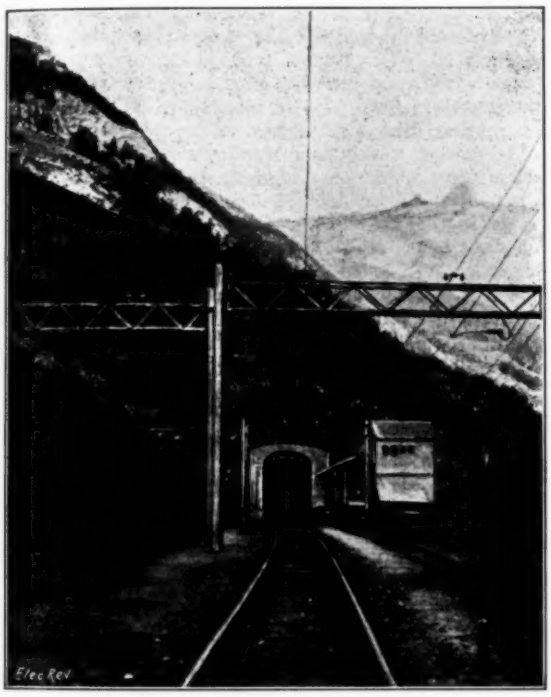


Fig. 5.—Overhead Construction at Goppenstein.

At the stations the trolley wire cross section is 55 sq. mm., the main trolley circuit being bridged round at these points. The trolley supports are of H-section steel with wide flanges, with steel brackets and double insulation; the normal span on the straight is 60 metres. In the main tunnel the supports are 22 metres apart, a copper-clad steel wire acting as the carrier. The trolley wire is placed 4.8 metres (15 ft. 8 in.)) above the rails in the tunnels, 6.7 metres (22 ft. 3 in.) at the stations, and 5.7 to 6.0 metres (18 ft. to 19 ft. 8 in.) on the open line.

A Run Over the Line.

Shortly after the termination of the Basle Conference in September, thanks to the intervention of Mr. Mayfarth, the managing director of the Sécheron Co., of Geneva, and the permission of the managing director of the Bernese Alps Railway, the writer was able to take a run over the line in one of the new locomotives. He went on board shortly before seven in the morning at the railway station of Spietz, which lies about 230 ft. above the lake of Thun; with a goods load behind the locomotive of 505 tons, after the slow start desirable with a long train, speed was rapidly picked up, and on leaving the station yard, up a rise of 1 in 66, it went up to about 40 km. per hour; shortly after leaving, a tunnel nearly a mile long was encountered; later the speed went up to 50 km. The main ammeter showed about 120 amps. with 17,000 volts, or 2,040 kVA. Up to Fruitigen the grades do not exceed 1 in 64. This section of the line was opened in 1902; Fruitigen is well known as the station for Adelboden. From Fruitigen to the northern mouth of the main tunnel there is a continuous grade of 1 in 37. On this section the speed repeatedly went up to 31 miles per hour, decreasing a little where the curves were very frequent. The pressure kept up very well at from 16,000 to 17,000 volts, the current at times being about 240 amps. at the lower of the above voltages, giving 3,840 kVA. The cab is arranged with six ammeters of a sector shape, one for each twin motor group; an ammeter and line voltmeter is arranged at each end, and an integrating wattmeter at one end. As with most locomotives on the Continent, a recording and indicating speed meter is fitted. For operating the contactors, a hand wheel is turned, a pointer showing how the control stands. The locomotives are capable of hauling 550 tons. The number of loaded trucks which can be hauled is limited by the pull allowed on the couplings and draw-gear of the trucks. It was useless, therefore, for the makers to arrange any multiple-unit gear, as, without a further locomotive at the back, one locomotive can take a train of the normal maximum weight.

There were two men on the locomotive; the mate had but little to do during the run; he controlled the two fans which blow air through the traction motors, according to the work to be done placing them in series or in parallel; for a material part of the time he looked out for the signals and called to the driver as he spotted them. The locomotive negotiated the 300-metre curves with great smoothness, without any of that lurching sometimes observable with steam and electric locomotives. The mechanical part of the locomotive was made by Ernesto Breda, of Milan, and the easy running reflected great credit on the makers.

Shortly after entering the tunnel, a white mist was encountered; this sometimes happens under certain atmospheric conditions, although there is no fog at either side in the open. The powerful headlights penetrated the mist very well. Later it was evident that a lot of water was coming through the tunnel walls, almost like rain. At one time after the opening of the line the 15,000-volt trolley line insulators gave a lot of trouble owing to the deposit of dust and salts from the percolating water. This has been got over to a considerable extent. To carry off the water the tunnel is arranged with a hump in the middle. At the southern mouth of the tunnel, fig. 5, the view towards the mountain top is very fine. After a comparatively short distance the line turns to the east, and the Upper Rhone Valley is seen over 1,300 feet below; the line lies on a shelf and slopes down to Brigue at about 1 in 45. During the run down the speed was kept at about 25 miles per hour; the electric brakes were used to a great extent, operating through resistances.

At Brigue a junction is made with the steam-operated section of the Swiss Federal line from Geneva and Lausanne, the lower part of which is operated on the single-phase system, also with $16\frac{2}{3}$ periods. From the station of Brigue onwards through the Simplon tunnel the traffic is worked by means of three-phase locomotives. The single-phase tracks are kept clear of those fitted with 3-phase overhead work, the goods and passenger trains being shunted from one line on to the other with the aid of a steam locomotive. During the recent difficulties in the Rhone Valley when, as a result of an avalanche, the Upper Rhone Valley railway was blocked, the traffic was taken over the Loetschberg *via* Berne.

Certainly there are few better ways of seeing a railway across Swiss mountains than from the cab of an electric locomotive, especially when the "Clerk of the Weather" shows what he can do.

The thanks of the writer are due to the Bernese Alps Railway Co. and to the Sécheron Co., of Geneva, for the above particulars. In the preparation of the notes use has been made of an article by M. L. Thormann, chief constructional electrical engineer.

Sag Calculations for Power Transmission Lines.

A consideration of the requirements for Overhead Conductors under varying working conditions due to changes in temperature, wind pressure, ice covering, &c.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

IT is now generally recognised that the modern construction of power transmission lines requires a more careful determination of the sags and tensions of the conductors. For such work, which nowadays involves much more steel construction and much longer spans than was the practice in the past, it is necessary to so choose the sags as to maintain a safe and economic balance between conditions such as:—

(*a*) The strength of line supports required to resist the conductor-tension, at terminal points and tangents in the line, with moderate or small sags; and

(*b*) The dimensions of line supports required for minimum ground clearance, and for proper separation of the conductors from each other, for large sags.

Without question, the material best suited in the majority of cases to meet these and other requirements for maximum economy is the hard-drawn copper conductor; for most of the bigger lines, cable would be used. In tower line construction the tendency has been to employ longer and longer spans, which practice has resulted in excessive cost of supports and, in many cases, an increased instead of a decreased insulator hazard. Due to this practice, the tendency is to reduce the maximum allowable tension. This condition naturally applies more rigorously to the higher-strength line conductors such as steel, aluminium-steel and copper-steel, than to the *all* aluminium and copper conductors. That is to say, for hard-drawn copper, 50 per cent. of the ultimate tensile strength would more generally be the rule, but, for aluminium-steel, only 40 per cent. or even 30 per cent. of the maximum stress may be used. Thus, from the strength point of view, the use of copper for the main line—excluding certain special spans, which will always employ copper steel (copperweld) where copper is used for the main line conductor—may be ample to meet all requirements.

For hard-drawn solid copper conductors, the above remarks for maximum allowable tension do not apply because the normal maximum tension of the largest size of conductor is no greater than 4,300 lb. It is very important that the *proper* sag of lines be given in each case. Too large a sag is objectionable for the reason that it may require higher line supports to give the necessary ground clearance required by law, or the span length may be reduced, which would in turn require a greater number of line supports, insulators, &c.; also, a larger sag would mean greater spacing of the conductors to prevent them from swinging together. Hence, there may be a disadvantage in the use of, for instance, too high a value for the modulus of elasticity E, where the smaller sizes of stranded conductors are used on fairly long spans. With a small conductor or a conductor of light weight used on a long span, it is often found that the sag just about necessary to keep within the elastic limit when subjected to its maximum loading in winter will produce a very slack line in summer, and, if very wide separation of the conductors is not allowed, they are likely to be blown together. This condition is made still worse where use is made of too high a value of E in the calculation for sag. In the United States, Canada, and other countries it is customary to use a higher value of E for solid than for stranded conductor; the commonly accepted value of E for solid copper (hard drawn) is 16,000,000 lb. per sq. in. As a small conductor is stronger than a large conductor of equivalent sectional area, the tension allowed in stringing should be greater than for the equivalent stranded conductor of large size; with this in mind, there may be reason for rating both solid and stranded conductors for one value of E. In this way the values are better "evened up" than is the case where the mechanical constants are changed by stretching stranded conductor so that W, A, *d*, &c., are different from the recognised values used in the original calculations for sag.

In the calculations for sag, many variables come into play. In the first place, calculations are made on the assumption that the supports are at the same level. We also start out assuming that the supports are absolutely rigid and that the conductors are fixed solidly to their supports, *i.e.*, that supports do not have any flexibility at the top, and that the conductors do not slip through their bindings at the insulators, or that the suspension insulators are not free to swing in the direction of the line, &c. Also, in the design of a line we start out knowing that there is, or that sooner or later there will be: (*a*) variation in weight and area of material from the value assumed in the original calculations; (*b*) uncertain value of tensile strength and/or elastic limit of the material from that assumed; (*c*) uncertain value of coefficient of expansion as well as modulus of elasticity; (*d*) variation of weight along the line due to non-uniformity of ice and/or to density of the ice varying through wide limits from the value originally assumed, &c. As an instance of a small change in the sectional area A, take the two standard sizes 0.025 sq. in. and 0.02545 sq. in. (the difference in area is 0.00045 sq. in.); in a 1,000 ft. span the difference of 0.00045 sq. in. in A will produce a difference of 36 inches in sag for the same temperature and same loading conditions.

For a given material the size of conductor has more of a determining effect upon the possible length of span than any other condition. For line supports at the same and at different levels, there is a proper ratio between the permissible span length, the size of conductor, and the different weather conditions; the most economical span is dependent upon many different and variable conditions—local, mechanical and electrical. Certain of the *actual* local conditions may never conform with the requirements of the Regulations for Overhead Lines. These Regulations intend to provide for safety as regards tension and sag, requiring that:—

(*a*) Maximum tension be taken at a temperature of 22 deg. F. Actually, the maximum tension occurs *at the lowest temperature* with the actual maximum loading; and

(*b*) Maximum sag be taken at a temperature of 22 deg. F. for maximum loading (see footnote Table II), or at maximum summer temperature. Actually, the maximum sag occurs *at the highest temperature at which sleet will form*, in conjunction with ice and wind loads, not the specified values.

Under maximum specified loading conditions the con-

ductor may be stressed to the maximum allowable tension of the material. The conductor is therefore longer under such conditions and the sag greater than an unstressed (or unstretched) conductor. If the temperature increases, the stress will decrease because the expansion of the conductor will cause an increase in sag. At a certain sag, the two tendencies will balance each other. On the other hand, if the maximum load is removed—as would be the case in summer—the decreased stress on the conductor will allow it to contract, thus decreasing the sag, which condition increases the stress, but in this case the sag is made greater due to the increased length or stretch of the conductor. These two tendencies also tend to balance each other. Thus, variations of temperature for any loading produce variations in the length of conductor, and variations of length produce variation in sag. As a conductor tightens up with a decrease in temperature, the resulting increase in stress stretches it, and the stretching keeps the stress below what it would be if there were no stretching. On examination of the tables, these various changes are seen to be evident. For instance, in winter the conductor is stressed to its maximum tension, and the sag under maximum loading conditions is seen to be as great or greater than under any other weather condition, *i.e.*, the conductor is stretched so that it is longer; also, when the maximum load is removed, the decreased stress in the conductor will allow it to contract, thus decreasing the sag, which condition tends to increase the stress; and, when the temperature is increased, the stress in the conductor is further decreased because the expansion in the conductor causes it to sag more; also, with a decreasing temperature, the conductor tightens up and the resulting stress stretches it—this stretch is the best indicator of the ability of the material to resist severe loads; on the other hand, a brittle conductor is a dangerous conductor, and demands a higher factor of safety.

The Regulations specify 24 tons per sq. in. or 53,760 lb. per sq. in. section for solid hard-drawn copper; for cable, a reduction factor should be taken into account. They also specify a factor of safety of 2.0, or an allowable tension of 26,880 lb. The elastic limit of hard-drawn copper is somewhat greater than one-half the ultimate tensile strength, and can be safely taken at 55 per cent. of the ultimate tensile strength. However, the values used in the accompanying tables for the different sizes are those recommended by the Electricity Commissioners* (see Table I). The modulus of elasticity E is specified as 18,000,000 for hard-drawn copper (solid *and* stranded); this value is high for stranded conductor; it is used in the tables for solid conductor. The value of the coefficient of linear expansion α is taken at 0.0000093 per deg. F. Maximum loading P refers to a load (specified by the Electricity Commissioners) of one-half inch radial ice coating and 8.0 lb. wind pressure (right angles to the line) at a temperature of +22 deg. F. (The *constant* for this wind pressure $p=0.0032v^2$; where $v=\sqrt{312.5p}$. In the United States and Canada the generally accepted value for $p=0.0025v^2$; where $v=\sqrt{400p}$).

As it is the practice to consider only *standard* sizes of conductors, and as one kind of material and one size of conductor for each transmission line (circuit) is the general practice, it is sometimes better to make a chart or diagram in terms of one size of conductor, for the use of men in the field. With time, the sizes given in the tables may change, but while the characteristics of the material remain the same, and the loading conditions remain unchanged, it is but a simple matter to plot a chart or graph, so that any size of conductor can be chosen to suit any standard, and any sag value can be determined from the tables for any span length and any change in temperature. The tables† should prove useful both as a means of quickly comparing results with changed loads and also for drawing diagrams or charts to cover any intermediate value of span, temperature and size of conductor, &c. In order that the erection gang obtain accurate values of sag and temperature (or tension, which is obtained by use of the general formula: $P=l^2w/8D$) for any intermediate span length, all that is necessary is for the engineer to mark off the values of sizes in use or to be used on the line, and plot the values on cross-section paper or on

TABLE I.—LOADING ON HARD-DRAWN SOLID COPPER CONDUCTORS UNDER THE ELECTRICITY COMMISSIONERS' RULES.

(*See foot-note Table II.*)

A	*d*	P	2P	Stress in tons per sq. inch.	*w*	$w_{1.1}=w+\cdot62\,(d+d_1)$	$w_{1.1.1}=\frac{3}{2}(d+2d)$	$W=\sqrt{w_{1.1}^2+w_{1.1.1}^2}$	Angle of resultant load.	$\cos\phi=\frac{w_{1.1}}{W}$ $(D_v=D_r\cos\phi)$*
Nominal area in sq. inch.	Diameter in inch.	Allowable tension in lb.	Ultimate tensile strength in lb.		Dead load per lineal ft. in lb.	Vertical load per lineal ft. in lb.	Horizontal load per lineal ft. in lb.	Resultant load per lineal ft. in lb.		
·01453	0·136	456·0	912	28·0	0·0560	0·451	0·758	0·882	59° 15′	·5113
·01629	0·144	508·0	1,016	27·9	0·0627	0·462	0·763	0·892	58° 50′	·5175
·01697	0·147	528·0	1,056	27·8	0·0642	0·466	0·765	0·896	58° 40′	·5200
·01815	0·152	561·5	1,123	27·6	0·0700	0·474	0·768	0·902	58° 18′	·5255
·02061	0·162	633·0	1,266	27·4	0·0795	0·490	0·775	0·917	57° 40′	·5348
·02164	0·166	662·0	1,324	27·3	0·0834	0·497	0·778	0·923	57° 25′	·5385
·02500	0·178	707·5	1,515	27·1	0·0959	0·516	0·786	0·940	56° 42′	·5490
·02545	0·180	770·0	1.540	27·0	0·0981	0·520	0·787	0·943	56° 35′	·5507
·02688	0·185	810·5	1,621	26·9	0·104	0·528	0·790	0·951	56° 15′	·5556
·02926	0·193	875·0	1,750	26·7	0·113	0·542	0·795	0·952	55° 42′	·5635
·03269	0·204	971·5	1,943	26·5	0·126	0·563	0·803	0·981	55° 0′	·5736
·03631	0·215	1,071·0	2,142	26·3	0·140	0·583	0·810	0·998	54° 15′	·5842
·0500	0·252	1,437·5	2.875	25·7	0·193	0·659	0·835	1·064	51° 44′	·6193
·0750	0·309	2,064·5	4,129	24·6	0·289	0·791	0·873	1·178	47° 50′	·6713
·100	0·357	2,655·0	5,310	23·7	0·386	0·917	0·905	1·288	44° 40′	·7112
·125	0·399	3,215·5	6,431	23·0	0·482	1·040	0·933	1·397	41° 55′	·7441
·150	0·437	3.750·0	7,500	22·3	0·578	1·159	0·957	1·504	39° 35′	·7707
·175	0·472	4,272·5	8,545	21·6	0·675	1·277	0·982	1·610	37° 30′	·7934

NOTE:—*Resultant Loading* = $\sqrt{(\text{dead } load \text{ a} + 0{\cdot}5 \text{ inch ice } load)^2 + (8{\cdot}0 \text{ lb. wind } load)^2}$; where: dead load = w, 0·5 inch ice = d_1, and 8·0 lb. wind pressure = p.

This wind pressure is assumed to correspond with a wind velocity of 50 miles per hour. therefore $p = 0{\cdot}0032v^2$ where $v=\sqrt{312{\cdot}5p}$. A very much used value for p is $0{\cdot}0025v^2$, making $v=\sqrt{400p}$. For solid wires the value $0{\cdot}003v^2$ appears to be a good mean; making $v=\sqrt{333p}$.

Quantity of ice per foot of length = $0{\cdot}0218d_1\,(d+d_1)$, in cubic ft.

Total vertical weight per foot of length = $w + 57 \times 0{\cdot}0218d_1\,(d+d_1)$, in lb.

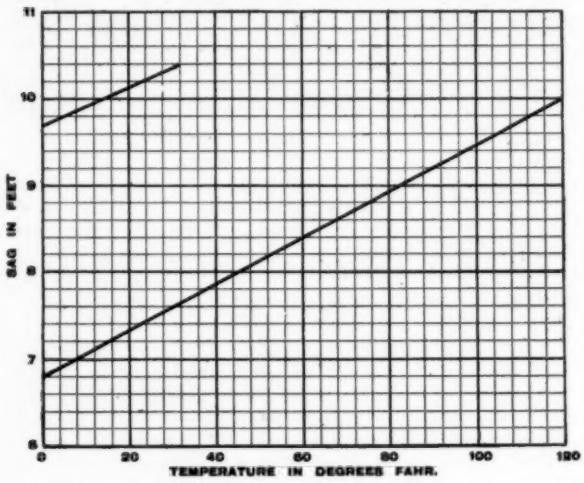
Load due to wind pressure per foot of length on the conductor = $0{\cdot}666\,(d+2d_1)$, in lb.

* As the resultant load increases, the vertical sag (D_v) decreases because of the greater angle of swing from the vertical plane.

* See also British Engineering Standards Specification, C.A. (E.L.) 6349.

† These tables replace Charts V and VIII for S.W.G. sizes given in the ELECTRICAL REVIEW, October 3rd, 1924.

logarithmic paper. This refers to old, present, or new standard sizes of conductors. For lines using but a few different spans, it is recommended that a curve be drawn for each span in the manner shown in fig. 1.



Sag Chart.—For span=400 ft.; 0.10 sq. in. hard-drawn solid copper; P=2,655.

The upper curve is for conductor loaded with half an inch ice and 8 lb. wind for temperature from 0 deg. F. up to freezing point of +32 deg. F. The lower curve is the "stringing" curve, and shows sags for any temperature between 0 deg. F. and +120 deg. F.

This class of stringing chart is recommended for the erection gang; if desired, other curves may be drawn in for other spans and for corresponding tensions.

In this example, "maximum" sag occurs at +22 deg. F. with load, or at a higher temperature (with load) at which sleet will form (see continuation of upper curve).

Fig. 1.—Transmission Line Stringing Chart.

The maximum stress conditions in a span are always assumed at the outset, and the first step in designing a transmission span is to look up the allowable value of tension P; this is given in column 3 of Table I. The maximum sag, which may occur either at the maximum temperature *with* or *without* load other than the bare conductor in still air (see fig. 1) is not known, and therefore must be determined. As conductors are never strung under actual maximum loading conditions, it is customary to string them so that, under maximum loading conditions, the stress in them will not exceed the loading specified by the Electricity Commissioners. In this country it is still common practice to use the dynamometer when stringing conductors. A better method is to find the sag for the particular temperature at the time of stringing (bearing in mind that on a sunny day the conductor is at a higher temperature than the air, hence a few degrees must be added to the reading given by the thermometer) and measure the amount of sag required for each span on the adjacent line supports by placing a dab of white paint at the measured levels, or by fixing an adjustable white batten on each adjacent line support at the measured sag level. A line of sight is then taken between these two points, and the conductor is allowed to sag until it coincides with this line of sight. A dynamometer is subjected to very rough handling in the field, and is very seldom tested for accuracy. The *sighting method* should preferably be the one chosen, as it is not only reliable and simple, but it should provide a permanent record on the line supports for present and future reference, and for re-sagging purposes, &c.

(To be concluded.)

Standard Performances for Electrical Machinery.

A critical review and some observations on Specifications Nos. 169 and 226, dealing with the working requirements of motors and generators, of the British Engineering Standards Association.

By F. T. CHAPMAN, D.Sc.

(Concluded from page 251.)

WE may now examine in detail the two specifications, Nos. 169 and 226, to which we have already referred. They are concerned with large generators and motors rated at more than 2.5 kVA or 2.5 b.h.p. per revolution per minute, excluding, however, alternators of the steam turbine-driven type, which come within the scope of a special specification, No. 225.

No. 169 is a specification for a rating permitting overloads, while No. 226 describes a continuous maximum rating. Both are drawn up in the same form; the main portion of the material is divided into thirteen sections, with the same titles in both cases, and the remainder is arranged in eight appendices. With a small exception in the case of the second, the appendices are identical in both specifications.

The first section describes the scope of the specification. The second and third define certain terms, such as "Rating," "Overload," and "Inherent Regulation," and describe the three types of enclosure which are recognised, *viz.*, "Open," "Duct Ventilated," and "Enclosed Self-Cooled." This is naturally a smaller number of types of enclosure than was recognised in No. 168 in the case of smaller machines. The fourth section defines certain types of machine, such as "Change-Speed Motor," "Variable-Speed Motor," and "Inverse-Speed Motor."

The most important matter in Section V is the specification of the permissible deviation from the sine shape in the e.m.f. wave of an alternator. Since there is no commercial analyser of proved reliability on the market at the present time, the Association has had to rely upon a graphical method of comparing the actual wave form with a sine wave having the same root mean square value. The specified test which the wave form must pass is that, when the two curves are superimposed so as to show the least difference, the maximum deviation between them shall not exceed 5 per cent. of the maximum ordinate in the case of alternators with outputs exceeding 2,500 kVA, nor 10 per

cent. in the case of alternators with outputs below this limit. Where a pronounced ripple of 400 per sec., or over, is present, the deviation of this ripple from a mean curve drawn through it shall not exceed 2½ per cent. of the maximum ordinate. In view of the number and nature of the processes involved in this test, its accuracy cannot be great. The clause is a very necessary one, however, and it is to be hoped that the advent of a satisfactory analyser may make it possible ere long to replace the present cumbrous test by something at once simpler and more accurate.

The next section (VI) relates to rating. The rating of a machine has already been defined in Section II as "the output assigned to it by the maker, together with the associated conditions marked on the rating plate." This is a clear and unambiguous statement, but in Section VI we are told that "the rated load defines a load which can be carried on test under the conditions of the rating and of this specification for an unlimited period without exceeding the limits of temperature rise given in Section VII." Presumably this means that "the rated load *is a* load which can be carried, &c.," and as there will be an infinite number of such loads for any given machine, the "definition" is not of much value. Perhaps the meaning of this statement would be conveyed better by some such sentence as this: "A machine rated in accordance with this specification will give a performance which will not fall short of the standards laid down here when tested in the manner prescribed herein and under the conditions of load, &c., stated on the rating plate."

The remaining sections deal with the tests to be made and the standards of performance which are to be attained, but there is a certain lack of clarity about the way in which they are set out. It would have been better if they had been preceded by a schedule summarising the prescribed tests, which are:—

(*a*) Load test, for the purpose of examining the temperature rise and the commutation.

(*b*) Overload, excess current and excess torque tests.

(*c*) Insulation resistance and high voltage tests.

In connection with (*a*), Section VII sets out fully the methods of measuring temperatures which are demanded and the maximum measurable temperature rise which the specification permits. Embedded temperature detectors are called for in all machines having an axial core-length of one metre or more.

Section VIII deals with momentary overloads under the title "Excess Current and Torque." Here the two specifications differ. According to No. 169, a generator is required to withstand a 50 per cent. increase of current beyond its rating for one minute, and d.c. and a.c. synchronous motors are required to withstand a 50 per cent. increase of torque without injury and without falling out of step, the voltage and frequency remaining constant. Induction motors must be able to withstand, in addition to the last test, an excess torque of 100 per cent. above normal for 15 sec., except where the number of poles is abnormally high. According to No. 226, the 50 per cent. excess current and torque must be applied for 15 sec. only, and induction motors are required to withstand 75 per cent. increase in torque instead of 100 per cent. The clauses relating to prolonged overloads in No. 169 occur in Appendix II, but as they are an essential part of the specification, it would appear that they should come in Section VIII with the other overload conditions.

The standard performance with regard to commutation (Section IX) is necessarily rather vague. The machine is to work "practically sparklessly" with fixed brush position and without injury to the surface of the commutator up to the momentary overload.

No standard of performance is given in the section relating to efficiency and power factor (Section X), but it is hinted that the purchaser should ask for guarantees, and a promise is held out that a standard method of verifying efficiencies may be published in the future.

A minimum insulation resistance of rated volts/(1,000 + rated output in kVA) is to be insisted on before the high-voltage test is applied. The methods of making the test and of measuring the voltage are well and fully described. The test voltage is to be raised and reduced slowly and maintained at its maximum value for one minute. The table of voltages which must be withstood by different parts of machines of different types calls for no comment.

The penultimate section deals with certain details relating to the carrying out of the tests, and the final section sets out the information which must be given on the rating plates of different types of machines. If any addition to the latter is permissible, the manufacturer might be required to state whether the insulation is class A or class B.

The first appendix gives a classification of insulating materials. The second refers to the conditions in respect of cooling air temperature and altitude within which the specification applies, and in the case of No. 169 it sets out the conditions relating to sustained overloads. It is not obvious why these clauses have been put into an appendix, for they would appear to be an essential part of the specifications.

The third appendix contains instructions for making the temperature measurements. This material also is essential to the purposes of the specification, and its proper place would appear to be alongside the other paragraphs relating to temperature. The same observation applies to the precautions to be observed in taking resistance measurements of windings for temperature determination, which form the subject of Appendix IV.

The suggestions to purchasers in respect of information to be sent to manufacturers with orders and inquiries come properly in Appendix V; Appendix VI, when ready, will deal with methods of declaring and verifying efficiencies, and Appendix VII applies to terminal markings. The final appendix relates to high-voltage tests, and contains eleven pages of matter bearing on the measurement of high voltages by means of spark gaps.

Specification No. 225, which was issued at the same time as those we have just discussed, relates to alternators of the type usually driven by steam turbines, and to exciters forming part of such sets. The general arrangement of the specification is similar to that of Nos. 169 and 226, but the sections relating to types of machine and types of enclosure are omitted.

Two ratings are recognised by this specification; one is the defined test rating and the other, which is called the "service rating," is the load "corresponding to the most economical output of the combined set." If required by the purchaser, this shall be stated by the maker and marked on the rating plate. A short-circuit test is not included in the standard test performance.

The specification concludes with the same eight appendices as occur in Nos. 169 and 226.

Although they are susceptible of improvement in form, these three specifications are very useful documents, and they increase the debt which the electrical community owes already to the British Engineering Standards Association.

Electric Cooking and Domestic Economy Teaching.

The London County Council instructed its Education Committee in 1923 to report whether or not at appropriate centres cooking by electricity should be taught. A report has now been prepared. The Elementary Education Sub-Committee states that at four cookery centres experimental electrical installations have been provided. The Sub-Committee proposes to continue the use of the electric cookers which have been installed. Electric cookers as well as gas will be installed in new centres serving districts in which the majority of children come from homes using electricity. In other cases no action will be taken, except where the supply authorities are prepared to furnish and install electrical equipment on exceptionally favourable terms.

Unemployment Insurance.

By JOS. J. H. STANSFIELD.

THE Report of the Blanesburgh Committee on unemployment insurances has just been issued. The Committee was appointed "to consider in the light of experience gained in the working of the unemployment insurance scheme what changes in the scheme, if any, ought to be made."

The report points out that unemployment as we know it is, comparatively speaking, a new phenomenon. Towards the end of the nineteenth century it became more manifest; in the first decade of this century it assumed more serious proportions; and in 1911 it was first made the subject of statutory enactment.

The Committee unanimously submits that the risk of genuine unemployment should be insured against, and that a compulsory scheme should be a permanent feature of social legislation.

It is estimated by the Government Actuary that unavoidable unemployment averages six per cent. over the period of a trade cycle, and whilst it will be generally admitted that there should be a careful examination as to the genuineness of the search for work, the worker who is unemployed through no fault of his own should be protected from the demoralisation that too often follows a period of unemployment.

The recommendation of a non-contributory scheme was not within the reference, but it was agreed that a contributory scheme should comply with certain conditions.

The worker's contribution must be moderate in amount and secure an insurance sufficient in the great majority of cases to save him during inevitable unemployment from recourse to public assistance; the insured contributor should not be tempted to improvidence when in receipt of good pay; the benefits should be less than the general labourer's rate of wages, so that there may be no temptation to prefer benefit to work; the mobility of labour must not be unduly interfered with, and those who would be benefited by a life overseas must not be deterred from emigration. Subject to these conditions, the scheme should be as attractive in its benefits to the insured contributor as, on a strictly actuarial basis, it is possible to make it.

Much has been said and thought about the abuse of the "dole," and it is satisfactory to note that the Committee shows that this has not occurred to anything like the extent which has been commonly supposed, but the suggestions as to contributions and benefits are designed to make abuse more difficult and less attractive.

Space will not permit of the publication at present of the full details of the rates proposed, but it may be generally stated that the rates of benefit and contribution would be smaller than those now in force, and that the contributions of employer, employé and the State would be equal in amount.

At present an employé is entitled to full benefits at 18, when the earning capacity is such as to give unemployment benefit a special attraction, and it is therefore proposed that a new classification should be adopted under which the benefits and contribution of employés aged from 18 to 21 should be below that of the adult.

The new scheme will start with a considerable load of debt. The coal stoppage increased the deficit from 7 to 21 million pounds, and in order to restore solvency a special contribution is suggested of a penny per week from men and young men, and a halfpenny per week from women and other contributors, until the deficit is wiped out. This proposal is calculated to meet with opposition, but it may be a reminder that the heavy disbursements during last year were not taken from an existing or unlimited hoard, but were rather borrowed in advance.

The question of unemployment insurance raises problems which more or less affect the morale of the community as a whole as well as the well-being, peace of mind, and self-respect of many millions of workers.

The Committee states, for reasons given, that public opinion outside the insured classes was and still is to some degree unfavourable to this class of insurance, but whether this view be well-founded or not it is satisfied that any scheme of unemployment benefit in this country will be durable and secure of general acceptance only so far as it is believed to be immune from the social dangers which, in greater or less degree, may lurk in such schemes.

An investigation made in 1913 showed that there was nothing to indicate that unemployment was being provided for by resort to the Poor Law or from any other outside sources, facts which are a notable tribute to the prudence, self-reliance, and self-respect of the insured workers as a whole, whilst under the Act of 1919 benefits were raised without altering the rates of contribution, and at the end of 1920 over £21,200,000 had been accumulated.

It cannot but be hoped by those who are anxious for the common good, that the future course of events will restore the financial solvency of a fund which is designed to provide benefits for all insured persons who can fairly be described as genuinely employed, and that some means may be found to avoid a recurrence of the disastrous circumstances of the past year.

The inquiry was primarily into unemployment insurance, but the Committee was impressed by the consideration that "preoccupation with the task of ascertaining how best unemployment can be insured against" must not weaken the efforts to get rid of unemployment itself, and a number of valuable suggestions are made to this end.

Amongst these may be mentioned a systematic inquiry by every industry into its own unemployment problem and its own supply of labour; a greater mobility of labour; and the helpful guidance of juveniles for their future careers.

The Report is one of 100 pages, and can be obtained from H.M. Stationery Office at the price of one shilling. It is well worth careful perusal, for it contains much that is interesting, informative, and suggestive.

Unemployment during January.

The *Ministry of Labour Gazette* reports that although unemployment in the engineering industry during January remained bad on the whole, there was certainly improvement. There was, however, a setback in the electrical engineering branch, the proportion of unemployed rising from 6.1 to 6.8 per cent. There was an improvement in the electrical wiring and contracting industry, in which the unemployment percentage fell from 8.2 to 8.0. On the other hand, the proportion of unemployed in the electrical cable, wire and lamp manufacturing group rose from 7.1 to 8.3 per cent. The actual numbers of unemployed were as follows:—Electrical engineering, 5,238; wiring and contracting, 1,113; and cable, wire and lamp manufacturing, 7,325.

Indian Electrical Notes.

(From Our Indian Correspondent.)

IT will be remembered that the opening of the electrified Harbour Branch at Bombay was the first step in introducing railway electrification into India. This service, which has since been extended to Bandra, forms only part of the various schemes at present in hand for the electrification of the suburban and main line services in Bombay, which on the Great Indian Peninsula Railway include the electrification of the main and suburban line to Kalyan, of the main lines to Igatpuri and Poona, and on the Bombay, Baroda, and Central India Railway, the electrification of the lines between Church Gate and Borivli. The work on the uncompleted portion of the schemes is being steadily pushed forward, and it is hoped soon to inaugurate an electrified service on the whole of these sections. With the opening of these services Bombay will feel a great benefit, and a better distribution of its great population may be looked for in the near future. The re-examination of the problem of suburban traffic in Calcutta is now approaching completion, and the preparation of a revised electrification scheme is in hand as a result of the decision to proceed with the construction of the Calcutta Chord Railway with a bridge across the Hooghly at Bally. The Madras suburban traffic problem is also being dealt with. Additional tracks are being provided on the suburban section of the South Indian Railway from Madras to Tambaram, and the electrification of this section is under investigation. The feasibility of electrifying other portions of the South Indian Railway is also being discussed, since there is a possibility of a hydro-electric supply being available. In view of the great benefits to be expected in railway working in South India from a hydro-electric supply, the Government of India has associated itself with the local government in the investigation of hydro-electric resources in the Madras Presidency, and the schemes are at present being examined by Messrs. Merz & McLellan, consulting engineers for electrification schemes to the Government of India.

The Chief Inspector of Mines' report for 1925, states that the number of collieries using electric power increased from 99 to 106, the aggregate horse power employed at collieries increasing from 43,502 to 52,336. During the year electrical plant was installed and brought into commission in thirteen additional coal mines. In two gassy coal mines, one in the Raniganj and one in the Jharia coal field, there was a considerable increase in the horse-power of electric motors installed below ground. The electrification of several important collieries is now in progress.

It is hoped that the preliminary work in connection with the Calcutta station of the Indian Broadcasting Company will be put in hand within a few weeks, so far as the transmitter building is concerned, and that it will be sufficiently advanced by early April to accommodate the first shipment of transmitting machinery. The aerial masts will be 150 ft. high, and the station will be of an ornamental and approved type. About five *cottahs* of land will be covered, while a further area will be utilised for the earthing system. Studios will be located in a carefully chosen vicinity so that interference from outside noises and any possibility of inconveniencing neighbouring residents may be reduced to a minimum. The company's manager is now engaged in examining sites that may prove suitable, and it is possible that Kyd Street or Park Street areas may offer the accommodation desired. The first programme will probably be broadcast in six months' time, but there are many difficulties still to overcome. Engineers from England are already on their way to India. As in other countries, programmes will be under the supervision of special programme boards, on which there will be Indian representatives competent to gauge the tastes of the great Indian population. Upon these boards will devolve the task of arranging programmes of wide appeal, and necessary adjustments as to the balance of the various items, such as lectures, "talks," music, &c., will be recommended by them. So far as Calcutta is concerned, interference from the spark station at Fort William is not anticipated as a serious difficulty. Technically there is little to fear in this respect, because the new station will transmit on a wave-length of 350-400 metres, while the Fort William station utilises a considerably greater wave-length.

X-Ray Martyrs.

According to the *Daily Chronicle* Special Correspondent, X-rays have claimed further victims in France. Sister Glossinde, who for 15 years assisted Dr. Reiss, of Metz, himself a victim of X-rays in 1923, has now died. The first symptoms were revealed after the war, and last year the sister had her right arm amputated.

Dr. Harcourt, chief of the X-ray department of a Marseilles hospital, had the forefinger of his right hand amputated on the 15th inst. He is 60 years of age, and has already undergone six operations. For his X-ray services during the war he was awarded the Legion of Honour.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Trans-Atlantic Telephony.

On February 15th, Sir W. MITCHELL-THOMSON, the Postmaster-General, informed Mr. Day that the number of telephone calls made on the Trans-Atlantic service since its inauguration was 338, of which 40 per cent. originated in England.

Broadcasting.

On February 15th, Mr. DUCKWORTH asked the Postmaster-General if he would state the attitude of his department towards the new regional broadcasting scheme; and whether there was any hostility to the development of alternative programmes on the part of either Government departments or commercial wireless services.

Sir W. MITCHELL-THOMSON said that he gave authority to the British Broadcasting Company last year to undertake experiments with the view of ascertaining whether a regional scheme could be adopted without causing interference between one broadcasting station and another, or between broadcasting stations and other wireless stations. The company conducted some experiments and the Corporation was at present arranging to carry out further experiments. The answer to the latter part of the question was in the negative.

Sir W. MITCHELL-THOMSON informed Mr. Grotrian and Major Ainsworth that his attention had recently been called to a case in which an experimental wireless station had been used for the transmission of concerts. The licensees claimed that those concerts were necessary for the purpose of scientific experiments which they were conducting; but he was not satisfied on that point, and he had asked them to discontinue the concerts until the matter had been considered in the light of certain information which he had requested them to furnish.

Sir W. MITCHELL-THOMSON informed Mr. G. Peto that he could not consider the reduction of the licence fee for crystal wireless sets to 5s. per annum.

Later, the Postmaster-General stated that the number of persons prosecuted for the use of unlicensed wireless apparatus from the autumn of 1925 to January 31st, 1927, was 583, and the number of convictions 579. The penalties ranged from a fine of 2s. 6d. to £10, in addition to £10 costs.

Beam Wireless Tests.

On February 15th, Mr. DAY asked the Postmaster-General if he would state the latest results of the official wireless beam test between Australia and Great Britain.

Sir W. MITCHELL-THOMSON said that the contractors stated that certain defects developed in the auxiliary apparatus during the recent test, and they were at present engaged in correcting those defects. When that had been done a further test would be arranged.

Agriculture and Electricity.

On February 16th, Sir H. HOPE asked whether it was contemplated to nominate any representative of the agricultural industry as adviser to the Electricity Board, so that the benefits of the Electricity Supply Act of 1926 might be secured for that industry?

Colonel W. ASHLEY said that the manner in which the Electricity Board could best keep itself informed of the special requirements of agriculture in connection with the supply of electricity, was a matter which it would be for the Board itself to determine as occasion arose.

Electrical Surveys.

During the discussion of Supplementary Estimates in Committee of the House on February 17th, on a token vote of £10 for the expenses of the Ministry of Transport, Col. ASHLEY explained that the vote was necessary to enable him to use certain appropriations in aid to meet an excess of expenditure incurred in connection with the Electricity Act of last year. Before bringing in that measure, the Government considered that it would be well to have independent outside technical advice, in addition to the advice given by the Electricity Commissioners. In the spring of 1925, a Supplementary Estimate for £15,000 was voted by the House, which enabled the Government to use money in the financial year 1925-26 to get that outside technical advice on the Weir Report and on the scheme generally. Not more than £10,500 was actually expended, and so, early last year, a sum of £5,000 was inserted in the Estimates as a re-vote, in order that the work might be carried on. That £5,000 was not sufficient to meet the expenses incurred in the general scheme and in the technical scheme of investigation up to December 15th last, when the Electricity Bill became an Act. On December 15th, any money for those investigations, according to the terms of the Act, became a charge on the fund under the control of the Electricity Commissioners, afterwards to be recovered from the Central Electricity Board. Up to December 15th, the money found by Parliament would be recovered, with 5 per cent. interest, from the Central Electricity Board when it functioned.

Mr. W. BAKER (Labour), who moved to reduce the vote by £5, asked for further details.

Mr. G. BALFOUR (U.) objected to the procedure which the Minister had taken, and contended that the matter should

come before the House at a later stage, so that the House and the country could understand what had been done.

Mr. HARRIS (L.) asked for the names of the consulting engineers who had advised the Government, and the amount of their fees.

Mr. D. HERBERT (U.) said it was wrong for a Government department to incur considerable expenditure on the assumption that a Bill before the House would become an Act of Parliament without alteration. Col. ASHLEY said that not one penny had been spent without Parliamentary sanction.

Col. WOODCOCK (U.) complained that money was being wasted on investigations into the Severn barrage scheme.

After further debate, Col. ASHLEY said that the surveys, general and special, cost in the financial year 1925-26, £10,500. In the current financial year, and up to December 15th, 1926, when the Act came into force, the cost was £19,000, making the total cost up to December 15th, 1926, £29,500. There would probably be a little more expenditure incurred after December 15th, and that would fall on the funds of the Electricity Commissioners, who would recover from the Central Board.

Mr. HARDIE (Lab.) complained that the information obtained in the surveys had not been made use of in connection with the Act. Col. ASHLEY said that the greater part of it had been included, as it had been used in the preparation of the scheme. The other part would be used by the Commissioners when they drew up their schemes for the consideration of the Board when it began to function. All that he had done was to instruct the Electricity Commissioners to prepare a scheme and to place the work of survey in the hands of Messrs. Merz and Kennedy. Those eminent consulting engineers were to engage appropriate staffs to make that general survey of Great Britain, and when that was finished they were to go into much more detail with regard to the areas with which it was proposed to deal first—Central England and the Glasgow and Clyde area. Detailed examination of the two areas was nearly finished, so that the Electricity Commissioners would soon be able to put up one or two schemes for the Board to consider. It would not be for the consulting engineers, nor for the Electricity Commissioners, but for the Board, to decide what areas should be taken next. The scheme for the areas which he had mentioned would be presented to the Board in the next fortnight or so.

The vote was agreed to.

Legal.

Scarborough Electricity Supply Co., Ltd.

MR. JUSTICE TOMLIN, in the Chancery Division on February 17th, heard a summons taken out by the Trust Union, Ltd., trustees for the debenture holders of the Scarborough Electricity Supply Co., Ltd., for a decision as to whether the debentures should be paid off at par or at 105 per cent.

Mr. CLEVELAND STEPHENS, for the applicants, said the company, in 1894, purchased the electricity undertaking from the Corporation, but the latter, under the terms of the transaction, re-purchased it in 1926. In 1923 the company issued £60,000 6 per cent. debentures, which were to be redeemed in certain circumstances at 100, 102, or 105.

Mr. DIGHTON POLLOCK, for the company, submitted that the debentures should be redeemed at par, but Mr. C. A. Bennett, K.C., for the debenture holders, argued that the redemption price should be 105.

His LORDSHIP said the trust deed contained a clause providing for the repayment of the debentures on a resolution for liquidation of the company, otherwise than for amalgamation or reconstruction, but there was a proviso that if the liquidation was for either of those purposes, the debentures should not be repayable except at 105. That event, however, had not happened, and his conclusion was that the debentures, on the true construction of the deed, should be repaid at par.

Stonebridge Electrical Co. v. Magneta Time Co.

MR. JUSTICE TOMLIN, in the Chancery Division, on February 14th, heard an application by the Stonebridge Electrical Co. to expunge from the register the trade-mark "Magneta" for electrical clocks. The respondents to the application were the Magneta Time Co., Carteret Street, Westminster.

Mr. BRAY, for the applicants, said this was a motion by way of answer to an action for alleged infringement of trade mark. There was an affidavit in support of the application raising two grounds of objection to the mark being on the register. The first, which was not before his Lordship now, was that the mark belonged to a Swiss company of that name; and the second was, that the renewal of the mark had been invalidated in those circumstances. In 1908 the mark was registered in the name of the Magneta Time Company, which had offices at Turnham Green, but a receiver of the company's assets was appointed, and he joined in the assignment of the mark and the company's goodwill to a Mr. J. W. Molden. In November, 1917, the company was dissolved. In February, 1918, Mr. Molden assigned the goodwill and mark to the present company, but neither assignment was registered, and the mark, having been put on the register in 1908, the 14 years had elapsed and there had been no proper application for renewal.

Sir DUNCAN KERLY, K.C., for the respondents, said the assumption that the mark lapsed at the end of 14 years if there was no application for renewal of registration was incorrect. Such a case as this was provided for, and in any event he submitted that a mark remained on the register until it was removed.

His LORDSHIP, in refusing the application, said the claim to expunge was based on a technicality. The error on which that technicality was founded was remedied in 1925, and apart from the technicality the present title to the mark was unimpeachable.

St. Austell Electric Light and Power Co. v. Beavis.

A CASE which had been before the County Court at four previous sittings was concluded at St. Austell on February 15th. The plaintiffs were the St. Austell Electric Light and Power Co., Ltd., who brought an action against Mr. A. H. Beavis in respect of rent for electric lighting fittings in a house of which he is the tenant, and also against Mr. Alfred Reed, the leaseholder, who claimed that the fittings became his when he bought the house. Mr. Reed further counter-claimed for a declaration that the fittings were his sole and absolute property, the claim of the company not having been brought to his notice when he purchased the property. His Honour Judge Gurdon found for defendants, with costs, with regard to the company's claims against Messrs. Beavis & Reed, and gave judgment for the company, with costs, on the counter-claim, holding that the freeholder had prior claim to the leaseholder.

American Electric Refrigerator Trade Activity.

The General Electric Co., of Schenectady, recently set up a separate department to handle its electric refrigeration business. The two refrigerator manufacturing plants which the company has been operating at Schenectady and Fort Wayne will be continued and expanded as the merchandising programme develops. According to the *Electrical World*, the G. E. electric refrigerator, which has been under development for the past fifteen years, is now being produced in two sizes for domestic use. The company's present plans call for a line of at least eight models of domestic refrigerators, ranging in price from $260 to $600. Some details are given of the merchandising system which will be followed. The new department will market refrigerators through electrical utilities, distributor-dealers and dealers. Distributor-dealers will sell direct to residential customers and also through sub-dealers in the territory allotted to the distributor. Most of the distributorships will be limited to one county or to a territory with a radius of not more than 25 miles. An extensive advertising programme, calling for an expenditure of $1,000,000 in 1927, has been planned, starting May 1st. "This includes a complete advertising service and sales assistance programme for distributors and dealers, consisting of co-operative newspaper advertising, direct-mail campaigns, booklets, publications, window displays and a full complement of dealer helps that will help distributors in localising the national campaign in leading national and trade journal publications."

Sales and Man Power.

Experience indicates that intensive sales efforts produce the best results. A large number of competent salesmen with a small number of prospective customers per salesman permits a degree of customer cultivation which results in maximum sales volume. In many cases, however, conditions are such that this policy must be modified seriously. A utility company may operate in a widespread territory where the income of the customers is limited. Again, competent salesmen are difficult to obtain and to retain unless they are paid a return greater than is warranted by the sales made. Thus the generalised statement on sales and man power is subject to modification in practice, but the principle is sound and should govern the development of sales programmes. The campaign method of sales or the use of specialty salesmen must be judged partly from this standpoint. A large group of refrigerator salesmen, for example, may be needed to sell the quota established for the sales period. It is a problem to get the men, and a still bigger problem arises at the end of the campaign period. A permanent sales staff is desirable, but large groups of specialty men are difficult to hold profitably during unseasonal sales periods or to adapt for selling general appliances. The summer campaigns create a heavy demand for salesmen, but the winter season calls for retrenchments and a slackening of some sales efforts. These points are doubtless kept in mind by utility sales managers in their efforts to stabilise the situation. Any individual plan for a single property must consider the man-power situation carefully and has to operate on the fundamental conception of building a permanent staff of salesmen who sell continuously and intensively.—*Electrical World*, February 5th.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

E.D.A.-E.L.M.A. Campaign.

The official report, dated February 21st, states that local circles were formed at Swindon (chairman: Mr. Nicklen) and South-East London (chairman: Mr. Wilson). Three more demonstration houses were opened at Portsmouth, Bath, and Belfast. From 750 to 1,000 persons are visiting the last-named house daily. An all-electric "house" was to be opened at the Town Hall, Basingstoke, yesterday (Thursday), and free competitions for children and adults are being arranged. Peterborough and Bermondsey have decided to run demonstration houses, while Halifax is to open a further house early next month. In Scotland, a house was to be opened at Aberdeen this week, and another in Glasgow is to be opened by the wife of the Lord Provost on Monday next. In co-operation with the Salford Corporation, the Prestwich Urban District Council was to open a house on February 23rd. Other demonstration houses in prospect are at Blyth, Durham, Sunderland, South Shields, Whitley Bay, Whickham, and Saltburn. Messrs. Ward & Co., of Cardiff, are erecting an all-electric bungalow outside the Cardiff Drill Hall. This will be run concurrently with an Ideal Home Exhibition which is being held in the hall. Exeter reports a daily attendance of 1,500 people at the demonstration house; it is expected that the total will reach 20,000 before the end of the display. Exhibitions are being held at Bradford (first week in March) and Bingley (February 25th to March 12th). The period of the Dumfries exhibition has been altered to March 2nd to 5th. Good results are said to have been obtained from the Falkirk and West Hartlepool exhibitions. The large working model of the prize house has stimulated the demand for competition booklets in the Liverpool and Manchester districts. In the North-East Coast area an impetus has been given by the children's competition.

The latest of the exhibitions of the Shropshire, Worcestershire and Staffordshire Electric Power Co. was held at Halesowen, Worcestershire, and proved very successful. There were a large number of visitors each day, and lectures were given by Mr. J. L. H. Cooper, the campaign officer for the South-Midlands Area, and Mr. C. C. MacLeod, of the company. The exhibition was arranged on the lines of a model home, sections being devoted to the kitchen, dining-room, bedroom, and bathroom, and in each of these demonstrations were carried out, which were watched with a good deal of interest. The Singer Sewing Machine Co. arranged a series of demonstrations of sewing by electricity. Wireless demonstrations were given by the Cable Accessories Co., Ltd., and by Messrs. Shaw Bros., the Halesowen agents for Burndept Wireless, Ltd. In a small industrial section were shown electric welders by Messrs. Holden & Hunt, Ltd., electric tools and soldering irons by Messrs. S. Wolf & Co., Ltd., and an electrically-driven fan forge by Messrs. W. Alldays.

Over 7,000 people visited the all-electric house at Shawlands in one week.

An all-electric house was opened on February 19th by the Luddendenfoot Urban District Council, near Halifax. The local electrical contractors and the Yorkshire Electric Power Co. (which supplies the Council with electricity in bulk) have co-operated in the organisation of the exhibition. The house was wired by the Electrical Distribution of Yorkshire, Ltd. The dwelling is one of the Council's parlour type, with three bedrooms and bathroom.

The Paisley Corporation Electricity Department recently held an exhibition of domestic electrical apparatus with the twofold object of advertising the new temporary showrooms and of furthering the campaign. The complete range of radiators, cookers, water heaters, &c., hired out by the Department was on view, along with the many other domestic appliances which may be purchased or hire-purchased. A good attendance was secured, and all who went were seriously interested in the electrification of their homes. Many hired appliances were booked out and numerous inquiries were received regarding the Corporation's scheme of hired installations. Every visitor to the exhibition was presented with a competition booklet.

Last week the Lady Mayoress of Belfast (Lady Turner) opened a demonstration house in Balmoral Avenue, organised by the Belfast Circle. This is a new villa lent by the builders (Messrs. A. M'Dowell & Co.), furnished by Messrs. Robert Watson & Co., and the electric wiring and fittings have been supplied by local electrical contractors and wholesalers. Presiding at the opening ceremony, Councillor Hyde said that, whilst during the past few years very considerable progress had been made in Belfast in the use of electricity for power, heating, and lighting, there was still much development work to be done.

The fifth Birmingham electric demonstration house, which is situated at Erdington, was opened by Lady Brooks on February 9th. A view of the house accompanies this note. The dwelling is floodlighted at night.

The Erdington Demonstration House.

An electrical exhibition, organised by local contractors along with Mr. W. Johnston, manager of the municipal electricity works, is to be held in St. George's Hall, Dumfries, from March 2nd to 5th. A complete electric kitchen will be on view, and there will also be a model shop window showing correct and incorrect methods of lighting, as well as a small electric laundry.

Aden as an Electrical Market.

Industrie und Handelszeitung (Berlin) reports that Aden is an excellent market for electrical apparatus. At the beginning of last year the town was provided with electricity, and new installations are still being carried out in large numbers. Not only are lamps required, but also fans, refrigerators, and many novelties.

Shop-Window Lighting Enterprise.

The *Huddersfield Examiner* reports that a local firm of bootmakers has installed a novel shop-window lighting system. Anyone who wishes to see the goods in the window when the shop is in darkness has only to press a button situated outside when the lights are switched on and remain on for a minute. The firm is to be commended on its enterprise—an opinion which will be endorsed by all the small boys in the neighbourhood.

The Scottish Lighting Service Bureau.

The first annual report of the Scottish Electric Lighting Service Bureau states that the number of people who attended the lectures at the Bureau was 1,711, while 962 people called for advice. The number who attended other lectures arranged by the Bureau was 882, making a total of 3,555. Free advice has been sought and given, states the report, on a great number of problems in illuminating by electric light in a diversity of directions.

New Belgian Company.

A company has lately been formed at La Louvière with a capital of two million francs and the title La Société Tréfilerie et Câblerie du Centre, to manufacture electric cables of all kinds.

Bermondsey Strike Settled.

The strike of outside employés of the Bermondsey Electricity Department appeared to be settled on February 17th. The Electrical Trades Union decided to accept as a member the man who was the subject of the strike, but at the same time it claimed that all men in the electrical installation department should become members. The matter was to be referred to the Trade Union Congress for its decision, which both the E.T.U. and the Borough Council agreed to abide by. Pending this decision, no men other than members of the E.T.U. were to be employed in the installation department. Later, however, it was reported that the man had refused to join the E.T.U., preferring another union. At the time of going to press the strike continued, but negotiations were proceeding.

A Lamp-Renewal Complaint.

The *Electragist* reports that a contractor-dealer in Hartford (Conn.), U.S.A., has applied for an injunction restraining the Hartford Electric Light Co. from exchanging and renewing lamps for a small fee, alleging that by this means the company has secured a monopoly of the "Mazda" lamp business inthe town, to the detirment of electrical dealers. It is further alleged that the loss of the lamp business has resulted in the loss of other business by the retailers. An agreement between the company and electrical dealers providing that the latter shall receive commission on the sale of appliances is held to be illegal.

Astoria Theatre Lighting.

The electric light fittings, some of which are five and six feet in diameter, installed in the new Astoria Theatre, London, are of excellent design. In collaboration with the electrical contractors, the Berkeley Electrical and Engineering Co., the General Electric Co., Ltd., designed and supplied the large fittings in the auditorium, together with electroliers and basket fittings for the foyer. These are designed on triple circuits for the use of multi-coloured lighting, which is controlled by means of dimmers.

Local Exhibitions.

AYR.—Ayr merchants and manufacturers are to hold an exhibition in the Pavilion, Ayr, from March 7th to 12th. Among the firms exhibiting will be the Eureka Vacuum Cleaner Co., Messrs. W. G. Dodd, Ltd., electrical and radio engineers, Messrs. Fairbairn, Ltd., radio experts, and Mr. Wm. Ross, electrical and radio engineer.

WEST HARTLEPOOL.—Mr. J. H. Parker, the electrical engineer of West Hartlepool, says that the local Co-operative Society has just held an exhibition to demonstrate that it is able to provide for the needs of the whole of the population. Included in the exhibit was a bakery section and café; the Borough Electricity Department loaned the Society three large ovens and two hot plates, total 30 kW, besides other electrical appliances. The exhibition ran for 10 days and was crowded out daily. The operation of all the working stalls was entirely electrical; there was no gas used on the premises. The exhibition has now been transferred for 10 days to the neighbouring borough of Hartlepool.

Price Reductions.

MESSRS. F. C. BLACKWELL & CO., LTD., Great Crosby Works, Liverpool, announce a large reduction in the price of the "Blaco" all-steel continuity fitting, in consequence of increase in demand and production and improved methods of manufacture.

MESSRS. A. REYROLLE & CO., LTD., announce a reduction in the price of their plugs and sockets, due to still further improvements in details of manufacture, and they are able to supply quantities from stock in any required finish.

Callender's at Leipzig.

Among the British companies which will be represented at the Leipzig International Industries Fair (March 6th to 12th) is Callender's Cable & Construction Co., Ltd.

New B.T.-H. Factory.

For the rebuilding of the section of the British Thomson-Houston Co.'s works at Rugby, which was recently destroyed by fire, the company is preparing plans for a factory, to be erected on the site of the old one, which will meet modern needs much more effectively. The old factory was built twenty years ago.

The Floodlighting of Quarries.

At the Barnhill Quarries, near Bristol, a number of G.E.C. standard floodlight projectors have been installed. These are equipped with 1,000-W "Osram" gasfilled projector-type lamps, and night shifts are being worked regularly with excellent yield results. These floodlights, which are portable, are used in conjunction with a number of G.E.C. Wembley lanterns, and electricity is generated by the quarry plant, which includes a G.E.C. alternator. The whole of the cables, fittings, and lamps have been supplied by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, the installation being carried out by Messrs. Rouch & Penny, electrical contractors, Bristol. Similar lighting has also been installed at the Town Quarries, Weston-super-Mare. In these workings the floodlight projectors are being fixed permanently by Messrs. Crowe & Green, the contractors.

Lamp Syndicate Developments.

It is announced that the Phoebus Company, of Zurich, which is one of the chief representatives of the International Glow Lamp Syndicate, has acquired by purchase the "Meteor" electric lamp works in Vienna, which has been one of the few works outside the scope of the syndicate. Negotiations are also proceeding with other outside firms, as, for instance, Gustav Glanz & Company, with a view to their inclusion in the syndicate.

The Prince Visits Hackney.

The Prince of Wales paid a visit to the Hackney municipal electricity works on February 15th at about 10 p.m. Upon his arrival the Prince was met by Alderman Mrs. Hammer (chairman of the Electricity Committee), Councillor W. J. Stapleton (vice-chairman), and Mr. L. L. Robinson, the borough electrical engineer. His Royal Highness displayed keen interest in the various parts of the works and chatted with the men on duty.

Factories.

Messrs. Leopold Farmer & Sons, of 46, Gresham Street, London, E.C.2, who, as our readers know, have a good deal to do with the letting and sale of factory and other business premises, report a very good demand at the present time for commercial property both in the provinces and in the London area and suburbs. This suggests that business is on the up grade and that further activity may be anticipated. We have received a copy of a paper on "Factories and Something About Them," which was read before the Auctioneers' and Estate Agents' Institute in December last by Mr. Harold L. Farmer.

State Aid for Japanese Engineers.

The Japanese committee for the promotion of home industries, appointed last year, has made a number of recommendations to the Government with regard to machinery manufacture. It recommends that the State should contribute towards the cost of training a body of technicians and mechanics, that State premiums should be paid in respect of well-equipped workshops whose products reach a prescribed standard, and that experimental and model workshops should be planned. It is also suggested that local associations of manufacturers should be formed with a view to improving the methods of production and organisation.

German Holdings in Russia.

It is stated that the shares of the former Russian General Electricity Company are still being dealt in, in the open market in Berlin, the valuation being put at about 4 per cent. In this connection Herr Deutsch, on the occasion of a recent interview, is reported to have been asked whether these shares were of any value. In reply, the director of the A.E.G. said that the shares were worthless, and there was not the slightest prospect that the shareholders would ever receive any return. It could not be thought that the Russian Government, which in general had expropriated capital, would return to that particular company a part of its property.

German Interests in Czecho-Slovakia.

It is reported that the conversion of the partnership company of Siemens & Co., of Prague, into a joint stock company, is to be accompanied by an extension of the interests of the German Siemens concern. The Prague company will receive considerable funds from the Siemens & Halske Company for the purpose of carrying out the conversion. Moreover, an enlargement of the Muglitzer works is contemplated; this works was recently amalgamated with Siemens & Co. It is also stated that the Siemens concern is about to acquire further interests in other Czech electrical undertakings.

Social Events.

The Meter Section of Blackpool Electricity Department held its second annual dinner on February 16th. Mr. E. Donoghue (charge engineer), who presided in the absence of Mr. C. Furness, general manager, spoke of the busy times which would be introduced by new legislation and the commercial development of electricity. Thanks were extended to Mr. Jackson, the organiser.

The second annual dinner of the employés of the Shropshire, Worcestershire and Staffordshire Electric Power Co. was held at Handsworth, Birmingham, last week, and about 250 were present from the company's headquarters and district stations. Mr. T. E. Boothby, the superintendent engineer, presided, and the toast of the company was proposed by an old servant, Mr. W. T. Penny. In response, Mr. J. T. H. Legge recalled the earliest days of the company, and expressed appreciation of the work of all who had assisted in carrying on the company's operations.

Recent Contract.

International Combustion, Ltd., states that its associate, S. A. Foyers Automatiques, Paris, has obtained a contract for a complete "Lopulco" installation to be installed at the Alost plant of the Société Générale de Soie Artificielle "Viscose." This order covers the supply of "Raymond" pulverising equipment, "Lopulco" hollow wall air-cooled combustion chambers with water screens, feeders, piping, burners, and electrical equipment. The normal rating of the boilers is 14,000 kg. per hour, with a peak-load rating of 18,000 kg. per hour.

Unemployment.

There was again a decrease (28,040) in the number of registered unemployed during the week ended February 7th. At that date the total was 1,303,500, as compared with 1,331,540 on January 31st, and 1,164,960 on February 8th, 1926.

The Wareham Electric Supply Co. : Petition for Compulsory Liquidation.

On Tuesday, before Mr. Justice Romer, the petition of Mr. W. E. Weston for the compulsory liquidation of this company was considered. Counsel said that it was a very serious case, a very gross fraud having been perpetrated. As further evidence was necessary, his Lordship adjourned the petition for 14 days for the necessary affidavits to be filed.

Calendars.

The 1927 calendar of Messrs. W. G. BEAUMONT & SON, Priory Works, Bow, E.3, bears monthly slips and a large coloured humorous drawing.

From the DELTA-STAR ELECTRIC Co., Chicago, U.S.A., we have received a 1927 calendar bearing a view of the company's 750,000-V testing laboratory. The company has also sent us one of its " bulletins " dealing with outdoor sub-stations.

Trade Announcements.

MR. C. F. MACKNESS, M.I.E.E., has removed from 37, Norfolk Street, Strand, W.C., to 28, Victoria Street, S.W.1. Telephone No.: Victoria 9355.

MESSRS. GREENWOOD & BATLEY, LTD., of Leeds, have appointed Messrs. Haslam & Stretton, Ltd., of 11, Windsor Place, Cardiff, to represent them in the South Wales district for the sale of their De Laval steam turbines up to 600 h.p., electric generators, a.c. and d.c., electric motors, traction motors, &c.

The business of BRITTAIN'S ELECTRIC MOTOR Co. (formerly Langdon-Davies Motor Co.), has been purchased and will be carried on at Eastdown Works, Dermody Road, Lewisham, S.E.13, by Mr. H. W. Hitching, as heretofore. Mr. Hitching has held the position of general manager for the last 15 years.

New Catalogues and Lists.

MESSRS. HOUGHTON-BUTCHER (GT. BRITAIN), LTD., 88-89, High Holborn, W.C.1.—" Radio News " for February, containing notes on the radio trade, details of new devices, and price lists.

ELECTRICARS, LTD., Landor Street, Birmingham.—An illustrated brochure dealing with storage-battery transport in industry and a pamphlet describing the company's refuse-collecting, &c., vehicles.

THE BRITISH THOMSON-HOUSTON Co., LTD., Rugby.—A reprint of an article from the *Illustrated London News* dealing with successes of cars fitted with " B.T.-H." magnetos.

HIGGS MOTORS, Witton, Birmingham.—February stock list of a.c. and d.c. motors. Priced.

MESSRS. SPENCER (MELKSHAM), LTD., Melksham, Wilts.—An illustrated brochure dealing with the company's machinery for handling materials in bulk.

THE MULLARD WIRELESS SERVICE Co., LTD., Mullard House, Denmark Street, W.C.2.—Four illustrated leaflets giving particulars and characteristic curves of the company's transmitting, modulating and rectifying valves.

MESSRS. E. BROOK, LTD., Empress Works, Huddersfield.—Pamphlet No. 119, containing notes on the company's production methods and illustrations of the works.

MESSRS. E. P. ALLAM & Co., LTD., 107-109, Gray's Inn Road, W.C.1.—A monthly stock list of motors for sale or hire.

MESSRS. SCOTT & HODGSON, LTD., Guide Bridge Iron Works, near Manchester.—A well-illustrated catalogue of the company's products, including a 12,000-i.h.p. mill steam engine, large rope pulleys, spur wheels, steel shears, rolling-mill drives, &c.

THE CAPAC Co., LTD., 11, Willow Avenue, Barnes, S.W.13.—An illustrated booklet describing the " Capac " binaural equipment for testing the internal conditions of machinery.

THE GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, W.C.1.—Leaflets Nos. 219, 259, and Y4,374, dealing respectively with field regulators, high-speed circuit breakers, and the " D.B. Minor " d.p. switch and fuses. Fully illustrated. Also Pamphlet O.S.4,366, dealing with the " Osram " Pearl " lamp, which is now made in the 100-W size.

SANTON, LTD., Dock Street, Newport, Mon.—An illustrated pamphlet describing the " Santon " electric belt for application to ordinary cylindrical tanks for water-heating purposes. Priced.

THE STANDARD INSULATOR Co., LTD., Winsley House, Wells Street, Oxford Street, W.1.—A brochure and a series of illustrated pamphlets dealing with " Rockbestos " (asbestos covered) wires and cables, for which the company are the sole agents for Europe (excluding Norway and Sweden).

THE NORMAND ELECTRICAL Co., LTD., 3, North Side, Clapham Common, S.W.4.—A leaflet setting forth one hundred and one uses for " Neco " fractional h.p. motors.

MR. A. H. GOWER, 23, Benbow Road, The Grove, Hammersmith, W.6.—A price list of " Ferrowatt " and other lamps and radio valves.

MESSRS. HOLLINGS & GUEST, LTD., Thimble Mill Lane, Birmingham.—A series of illustrated catalogues (priced) of the company's hydraulic presses, industrial stoves, &c.

MR. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—An illustrated pamphlet describing " Hazemeyer " dimmers and regulators for kinemas and theatres. Priced.

Bankruptcy Proceedings.

F. C. SNOOK, 66, High Street, Plumstead, S.E.18, lamp shade manufacturer.—The public examination of this debtor was held recently. The statement of affairs showed liabilities of £898 against assets of £68. The debtor commenced business on his own account in March, 1923, at which time he was experimenting with some electric lighting devices. The business was successful until he became short of working capital. A limited liability company was formed in July, 1926. Debtor said that he was to receive a weekly salary, and he intended to make his creditors an offer. The company had since gone into voluntary liquidation, but he would get substantial compensation under a service agreement. The examination was adjourned.

E. W. KIRK (ACE RADIO MANUFACTURING Co.), wireless apparatus maker, 26, Curzon Street, Derby.—Receiving order made February 9th on debtor's own petition. First meeting held February 24th at the Official Receiver's offices, 4, Castle Place, Nottingham. Public examination, March 22nd, at the Court House, Derby.

E. O. HENSTOCK, electrical engineer, 21, Old Road, Brampton, Chesterfield.—Trustee, Mr. L. A. West, Official Receiver, 4, Castle Place, Nottingham, released February 8th.

C. W. WATSON, electrical and wireless engineer, 33, Rainhall Road, Barnoldswick, Yorks.—Last day for proofs for dividend, March 1st. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

E. D. S. MUNDAY, electrical engineer, 272, Lake Road, Portsmouth.—First and final dividend of 2s. 4½d. in the £, payable February 28th at the Official Receiver's office, 87, High Street, Portsmouth.

J. REFOY (Varley Radio Co.), dealer in wireless apparatus, 178, Ancona Road, Plumstead, S.E.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released February 10th.

Company Liquidations.

RAI-IO (HOVE), LTD., manufacturers of radio apparatus, Westbourne Place, Hove, Sussex.—A meeting of creditors was held on February 15th at the offices of Messrs. Painter, Mayne & Walker, Cannon Street, E.C., when Mr. A. C. Gillman, the liquidator of the company, presented a statement of affairs which disclosed assets estimated to realise £117. That amount was insufficient to fully discharge the claims of the debenture holders and preferential creditors. There was a deficiency as regarded the debenture holders of £161, and there were no assets available for the unsecured creditors, who were scheduled for £223. The company had created debentures for £200, bearing interest at the rate of 10 per cent. per annum, and £25 was owing in respect of interest. No resolutions were passed, and therefore the voluntary liquidation of the company will be continued with Mr. Gillman as liquidator.

RADIO CABINETS, LTD., Whitehorse Yard, Essex Road, N.1.—A meeting of the creditors was held on February 15th, when it was decided that the voluntary liquidation of the company should be continued with the present liquidator, Mr. Hibbert. An advisory committee was also appointed.

NEUTRON, LTD.—Winding up order made by the High Court on February 15th.

BRITISH WIRELESS SUPPLY Co. (1924), LTD.—Last day for proofs for preferential claims for dividend, March 5th. Liquidator, Mr. H. H. Busfield, 12, Northgate, Bradford.

SOUTHERN COUNTIES ELECTRIC LIGHT AND POWER SUPPLY, LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. D. Gestetner, Ltd., of Aldwych House, Aldwych, W.C., creditors, and will be heard in London on March 1st.

Dissolution of Partnership.

ALLEN & EDWARDS, electrical and mechanical engineers, 106, Albany Street, N.W.—Mr. G. Allen and Mr. F. R. Edwards have dissolved partnership. Mr. Allen will attend to debts and will continue the business under the style of G. Allen and Co.

Receiver Appointed.

ACCUMULATORS OF WOKING, LTD.—On February 16th Mr. H. Tansley Witt was appointed receiver on behalf of the debenture holders.

United States Exhibitions.

The sixth annual Electric Sign Show was held in the New York Edison Co.'s showroom from February 14th to 19th, and over 200 signs and advertising devices were displayed. Other exhibitions which are being held at the company's showroom are the seventh annual Electric Truck Show (March 14th) and the fifth annual Electric Power Show (February 28th to March 5th).

New Cable Company.

We have received from MESSRS. CENTURY CABLES, LTD., of 137, Victoria Street, London, S.W.1, an announcement of the registration of which appears in our "Financial Section" to-day, a pamphlet entitled "The Making of Electric Cables." It contains aerial and exterior views of works which have been purchased at Addlestone, Surrey, for the manufacture of all types of cables, and gives a brief description of the operations of cable manufacture, accompanied by a number of pictures of cable-making machinery.

Book Notices.

In *Electrical Communication* for January an interesting article by Mr. Rollo Appleyard appears, on André Marie Ampère; the life story of the great French mathematician and physicist, who discovered and established on a sound basis the fundamental laws of electro-dynamics, is told in masterly fashion.

To the same issue Mr. J. E. Kingsbury contributes some personal reminiscences of Charles E. Scribner, the inventor of the multiple telephone switchboard and a telephone engineer of the first rank, who introduced the "common-battery" system of working into this country in 1900.

The price of the Post Office Electrical Engineers' *Journal* to annual subscribers has been reduced to 5s. per annum, postage extra; single copies will still be 1s. 6d. each, and this price will appear on the cover. The new price comes into force with the April issue, the size of which will be altered, forming the first part of Volume XX.

"The *Mechanical World* Electrical Pocket Book, 1927." Pp. 400; figs. 133. Manchester: Messrs. Emmott & Co., Ltd. Price 1s. 6d.—This new issue has been revised and brought up to date. New sections have been added, including one on a.c. commutator motors, in which the principles of construction of various types are described and illustrated. Another interesting feature is a chapter on electric lighting and power in villages, in which various systems of supply are considered and many data given.

"Double Helical Gearing." By the technical staff of Messrs. David Brown & Sons (Hudd.), Ltd. Pp. ix+134; fully illustrated. Published by the above company.—This is the second of a series of treatises on the design, manufacture, and application of double helical gearing, with special reference to DBS reducing gears and turbine, haulage and rolling-mill gearing. This well-written and useful book is available to all responsible engineers and executives on receipt of 1s. to cover the cost of distribution.

"Electrical Condensers," by P. R. Coursey. Pp. xxiv+637; 514 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 37s. 6d. net.

"Deafness Explained," by C. M. R. Balbi. Pp. 46; illustrated. London: John Bale, Sons & Danielsson, Ltd. Price 1s. net.

"X-Rays, Past and Present," by V. E. Pullen and W. J. Wiltshire. Pp. 14+229; figs. 43. London: Ernest Benn, Ltd. Price 12s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXV, No. 362. February, 1927. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

Scientific Papers of the U.S.A. Bureau of Standards. No. 539. "Radiometric Measurements on the Carbon Arc and other Light Sources used in Phototherapy." (15 cents.)

"The Purification of Industrial Waters" (107 pp.; 69 figs.). London: The Paterson Engineering Co., Ltd.—Although this deals particularly with the company's own apparatus, it is in the nature of a treatise upon the subject of water purification. A number of methods of treating boiler-feed water, &c., are explained in non-technical terms.

Transactions of the Institution of Engineers, Australia. Vol. V, 1924. Sydney: The Institution.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVI. No. 2. February, 1927. New York: The Institute. Price $1.

Continental Wire Trust.

It is announced that in the course of meetings held last week at Cologne, delegates of the wire-drawing companies of Germany, Belgium, Czecho-Slovakia, and Holland decided to ratify once more the present agreement only so far as concerns the prices to be fixed for each group and their quotas for export. There is no change in the present prices. The provisional agreement came into force on February 15th, and will in the near future be transformed into a definite international agreement to remain in force for several years.—*Reuter* (Brussels).

New Italian Company.

A new company has been formed at Benevento with a capital of 200,000 lire, and the title La Società Elettrica del Vitulanese.

The Economics of the Electrical Industry.

The British Electrical and Allied Manufacturers' Association has prepared a "Monograph on the Electrical Industry" for presentation to a committee preparing matters for the consideration of the International Economic Conference of the League of Nations. This surveys the world production of electrical goods and the markets for them; deals with developments in organisation and technique; and with production costs and selling prices. A mass of useful statistics is tabulated in various forms.

The Norwegian Electrical Market.

In the course of a survey of the Norwegian import markets, the Oslo correspondent of the Federation of British Industries says that British radio material is in good demand, but the United States and Germany are strong competitors. The demand for electrical heating and cooking apparatus is mainly met by Norwegian manufacturers.

New Indian Company.

A company has recently been formed at Aligarh, United Provinces, with a capital of 10,000,000 rupees and the title of the Aligarh Electric Supply Co.

For Sale.

Liverpool Electricity Supply Department invites offers for a number of second-hand d.c. motors. The County of Dublin Commissioners have for disposal two Corliss valve compound steam engines, coupled to two 500-kW alternators, and one Alley & McLellan surface condenser, &c. (See our advertisement columns to-day.)

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price Feb. 22nd.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4¼d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£13 10s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3½d. to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4a.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£107 to £112	...
b ,, Wire	per lb.	1/6 to 2/-	...
b ,, Sheet	,,	1/3 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£271	£4 inc.
Grade II	,, ,,	£187	£2 inc.
Grade III	,, ,,	£96	...
c Brass (rolled metal 3" to 12" basis)	per lb.	9¾d.	...
c ,, Tubes (solid drawn)	,,	11¾d.	½d. dec.
c ,, Wire, basis	,,	9¾d.	½d. dec.
c Copper Tubes (solid drawn)	,,	1/0½	½d. dec.
c ,, Bars (best selected)	per ton.	£86	£2 dec.
c ,, Sheet	,,	£86	£2 dec.
c ,, Rod	,,	£86	£2 dec.
d ,, (Electrolytic) Bars	,,	£60 10s.	...
d ,, ,, Sheets	,,	£148 10s.	...
d ,, ,, Wire Rods	,,	£74 15s.	...
d ,, ,, H.C. Wire	per lb.	9d.	...
f Ebonite Rod	,,	2/8 to 2/8	...
f ,, Sheet	,,	2/8 to 2/8	...
a German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/3½	½d. dec.
i Iron Pig (Cleveland No. 3.)	per ton.	122/6	...
i ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£29 10s.	10s. inc.
g Mercury	per bot.	£17 5s. to £17 10s.	...
e Mica (in original cases) small	per lb.	3d. to 8/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/8½	...
p ,, ,, drawn bars & rods	,,	1/8	...
p ,, ,, rolled strip & sheet	,,	1/9½	...
p ,, ,, wire	,,	1/8½	½d. dec.
e Platinum	per oz.	£28	...
d Silicium Bronze Wire	per lb.	10½d.	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£307 to £307 10s.	£3 10s. inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co,. Ltd
g James & Shakespeare.
h Edward Hill & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lighting and Power Notes.

Alloa.—TRANSFER OF UNDERTAKING.—The Town Council has given notice of its intention to transfer its electricity undertaking to the Scottish Central Electric Power Co. The transfer is to be made as from January 1st last, and the purchase price is £100,000.

Bedford.—ELECTRICITY IN BULK.—For the purpose of affording a bulk supply of electricity to the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., the Corporation Electricity Committee has recommended the sale to the company of land at Sandy for erection of a sub-station.

Chile.—HYDRO-ELECTRIC SCHEME.—A contract has been concluded between the Santiago Traction and Lighting Co. and the Compañia Chilena for the construction of a hydro-electric plant on the Maipo River, with a minimum capacity of 52,000 kW. The power available from this river is approximately 70,000 kW, which will be barely sufficient for immediate purposes, which include electricity for 25 miles of the Transandine Railway. Other sources will therefore have to be found. The growth of the supply of electricity in Santiago to the State railways and other consumers has been very rapid, sales having increased from 55,000,000 kWh in 1922 to over 120,000,000 kWh in 1926.—*Reuter's Trade Service* (Santiago).

Clitheroe.—ELECTRICITY SUPPLY.—The electricity supply for the district is to be formally inaugurated on March 3rd. The h.p. cable is to be extended to Chatburn, where the charges will be 8d. per kWh for lighting and 2d. per kWh for heating, cooking, and power.

Continental.—SWITZERLAND.—The Geneva correspondent of *The Times* reports that the recent completion of the Vernayaz power station of the Swiss Federal Railways—in Canton Valais—brings to an end the construction of the Barberine-Vernayaz hydro-electric plant, the largest in Switzerland. Its aggregate capacity will be over 180,000 h.p. The construction and equipment of the Barberine-Vernayaz plant has cost nearly £1,600,000, and the electricity produced is transformed on the spot and distributed to the railways by several sub-stations. The greater part of the power goes to the electrified lines of Western Switzerland, while a small part is transmitted 80 miles northwards to feed the lines of Northern Switzerland. The plant is also connected with the Amsteg-Ritom plant, on the St. Gothard line, a distance of 100 miles, so that its power can be distributed all over the network of the Swiss railways.

The municipal authorities of Geneva have received Government authority to "export" electricity to industrial works in the Bellegarde district of France. The concession, which is to remain in force until the end of 1930, provides for a maximum export of 2,000 kW, the daily quantity supplied not to exceed 48,000 kWh, and this only during the April-September period.

ANDORRA.—The Sociedad Electro-Harinera Andoranna is establishing a central power station for the supply of electricity in the Republic.

GERMANY.—Considerable developments have been made in the electricity supply industry in Germany. The largest electricity supply concern is the Elektrowerke Gesellschaft, of Berlin, whose 110,000-V lines supply the whole of the Central German industrial area. The annual output now amounts to 1,577,000,000 kWh. In 1925 the company extended its power stations to a capacity of 400,000 kW and added several hundred miles to its h.p. network. The Sachsischewerke, controlled by the Free State of Saxony, is connected up to the stations of the Elektrowerke. The Saxon concern has a lignite power station at Hirschfelde, with a capacity of about 100,000 kW, and a second lignite station is under construction near Leipzig. In 1925 the output amounted to 386,000,000 kWh. In addition, a supply of 156,000,000 kWh was taken from the Elektrowerke. The company paid a 10 per cent. dividend on the share capital of £1,000,000. The Rhenisch-Westfalische Elektrizitatswerk, of Essen, increased its output during 1924-25, by 60 per cent., to 1,099,000,000 kWh. The total capacity of the power stations of the company is 475,000 kW, of which 290,000 kW is accounted for by the Goldenbergwerk, near Cologne.

Darlington.—ELECTRICITY SUPPLY.—The Rural District Council has given permission to the Corporation to supply electricity within the parishes of Blackwell and Hurworth and Croft, and to the Cleveland and Durham County Electric Power Co. to supply electricity to Brampton, Great Burdon, Haughton, Morton Palms, Neasham, Sadberge, Whessoe, and nine other parishes.

East Grinstead.—ELECTRICITY IN BULK.—The Urban District Council has been informed by the borough electrical engineer of Tunbridge Wells that it is hoped that a bulk supply of electricity for the district will be available by next autumn. The scheme will also include Crowborough.

Glasgow.—HIRE-PURCHASE SCHEME.—The manager of the electricity undertaking has reported to the Sub-Committee on Propaganda that the Corporation has adopted a ten-year hire-purchase wiring scheme. The sub-committee has recommended that he be authorised to expend a small sum in advertising the scheme.

PROGRESS DURING JANUARY.—During January 106 houses were wired under the Electricity Department scheme, making the total to date 3,236, and there were 251 applications for the hire of domestic appliances, making the total to date 14,279.

Gravesend.—LOAN.—The Town Council has applied for sanction to a loan of £12,647 for the installation of a new boiler at the electricity works, which has already been ordered.

STREET LIGHTING.—The lighting in certain streets is to be improved at an estimated cost of £1,150.

Ilford.—LOAN.—The Electricity Committee is applying for sanction to the borrowing of £50,000 for mains and services.

India.—PYKARA HYDRO-ELECTRIC SCHEME.—The Pykara scheme, which is the largest hydro-electric scheme in the Madras Presidency, was submitted to Messrs. Merz & McLellan for investigation. They have made their report, recommending the Government to begin by first supplying electricity in the area round about Pykara with a view to creating some demand for it, and afterwards to proceed with the electrification of railways which, in their opinion, should be a secondary object. They have also expressed the view that the scheme has been under-estimated, and they have advised the Government to ascertain beforehand what the actual power requirements would be near the source before launching the scheme. The Government has appointed an expert committee, which, it is reported, has been successful in obtaining the support of cotton and other mills in the neighbourhood.—*Reuter's Trade Service* (Bombay).

Inverness.—PURCHASE OF PLANT.—On the recommendation of the Electricity Committee, the Town Council has agreed to purchase the Bught hydro-electric plant and acquire the water rights for £850.

Irish Free State.—THE SHANNON SCHEME.—It is understood that the erection of masts in the Dublin to Waterford loop of the Shannon scheme is to be begun immediately. Electricity will be transmitted at 38,000 V from Dublin to Bray, Wicklow, Arklow, Wexford, New Ross, and Waterford. From Waterford the line will pass through Kilkenny to Carlow, Athy, Maryborough, Kildare, and Dublin. The route has been surveyed, and the masts have been placed in readiness for erection.

Lichfield.—MAINS EXTENSIONS.—The City Council is to carry out mains extensions to various parts of the city, at a cost of £4,550.

London.—ST. MARYLEBONE.—The Electricity Committee has received a report from the borough electrical engineer on the future development of the electricity undertaking, in which he states that the five 2,000-kW Parsons turbo-generators installed at Richmond Street station are more or less obsolete, and a considerable saving in working costs, as well as increased generating capacity, would result from the replacement of the whole of this plant. The two 3,500-kW Oerlikon turbo-alternators, although serviceable for some years yet, occupy space which could be used to better advantage. He has recommended the installation of two 20,000-kW turbo-alternators, &c., at an estimated cost of £174,000, in place of two 2,000-kW sets and two 3,500-kW sets. This proposal provides an installed capacity of 74,500 kW, and approximately 50,000 kW of demand capacity. The scheme would be carried out in two stages, and the second stage would include additional boiler and cooling-tower plant, at an estimated cost of £30,500. He also gave figures showing the difference in favour of generation on site with increased bulk supply. The Electricity Committee has recommended that the report be submitted to the Electricity Commissioners and that they be informed that the Council would be prepared to apply for approval to plant extensions and for loan sanctions for the expenditure involved. Sanction has been received to a loan of £29,966 for the acquisition of property in Aybrook and Blandford Streets for electricity purposes.

HAMMERSMITH.—The Electricity Committee has recommended to the Borough Council that a supply of electricity be provided for the Wormholt housing estate of the L.C.C., and that the Council undertake the wiring of the houses to be erected, the total cost of the scheme being £19,083, made up as follows:—Wiring installation of 662 houses, £6,102; h.p. and l.p. mains, £8,517; provision and equipment of sub-stations, £823; services, £3,641.

ISLINGTON.—The Finance Committee has recommended that application be made for sanction to a loan of £29,137 for new boiler plant at the electricity works.

BERMONDSEY.—The Electricity Committee is applying for sanction to loans of £22,000 for mains and services, £5,000 for meters, and £10,000 to cover capital expenditure during the year.

HACKNEY.—The Electricity Committee has recommended that the increase of 25 per cent., made in certain electricity charges owing to the higher cost of coal, be withdrawn.

SOUTHWARK.—The inquiry into the Borough Council's application for sanction to extend its power station was concluded on February 11th. Mr. S. Morse, for the London Power Co. and the County of London Electric Supply Co., Ltd., who were opposing the application as ratepayers, states that his clients had powers to supply in certain parts of the borough, and the fact that the Council had within its area the mains of three companies, each with large generating resources, and able to give the whole supply required by the borough, made the extensions proposed by the Council unnecessary. Evidence was called to show that a bulk supply would be more economical in the interests of the ratepayers than incurring expenditure for the purpose of extending the existing system controlled by the Borough Council. An expert witness pointed out that the acceptance of bulk supply would relieve the Council of certain responsibilities, substantially reduce the expenditure, and would, therefore, be of all-round benefit to Southwark. The Electricity Commissioners will give their decision in due course.

Louth.—ELECTRICITY IN BULK.—The Town Council has asked Grimsby Corporation for the lowest terms upon which it would give a supply of electricity in bulk.

Middlesbrough.—ELECTRICITY SUPPLY.—The Electricity Commissioners' decision relative to the Corporation's application for sanction to borrow £140,000 for the erection of a new generating station has not yet been received. Meanwhile there has been correspondence between the Corporation and the Cleveland and Durham Power Co., which now provides a bulk supply. The Corporation has informed the company that, while its second offer for a supply is an improvement upon the first, the conditions have not changed, and the result of the Commissioners' inquiry is awaited. The Corporation is still open to negotiate even if sanction to erect its own power station is received.

Milnrow.—LOAN.—The Urban District Council has applied for sanction to a loan of £1,830 for extending the electricity supply on the Holt estate and to the Newhey Brick Co.

Northern Ireland.—PORTADOWN (CO. ARMAGH).—A deputation from the Town Council and consumers, which waited on the managing director of the Portadown Electric Co. with regard to the emergency that has arisen owing to the destruction of the power station by fire, was informed that some days must elapse before the company could give any definite information as to the probable date when a supply would be resumed from the power station. The company, however, would raise no objection to any consumer obtaining a supply of electricity from any source during the time its supply was not available, and no proceedings would be taken against any person or firm who might give a supply. Negotiations have been opened between representatives of the company and a local firm for the use of an engine and premises capable of generating sufficient electricity to supply all consumers. If a satisfactory arrangement can be arrived at, it is anticipated that the company will be in a position to give a supply to consumers within a week or ten days of the conclusion of the negotiations.

NEWRY (CO. DOWN).—The Urban District Council is applying to the Electricity Commissioners for Northern Ireland for a Special Order authorising it to supply electricity in the district. The estimated cost of the scheme is £25,000.

Preston.—ELECTRICAL DEVELOPMENT.—The Town Council is applying for sanction to proceed with the provision of a fourth turbo-generator at the Ribble power station, at a cost of £140,000, thus bringing the total capital outlay on the undertaking to nearly £1,500,000. Electricity is already supplied to Leyland, through the Lancashire Electric Power Co., and next winter Blackpool will receive a supply. There has already been an inquiry respecting a supply for Southport.

Shrewsbury.—TRANSFER OF UNDERTAKING.—The Corporation has sealed an agreement for the transfer of its power station to the West-Midlands Joint Electricity Authority. The agreement provides that the actual completion of the purchase of the generating station will not take place until an adequate supply of electricity is available for the borough from the h.p. mains proposed to be laid down by the Joint Authority.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Whitchurch and Pangbourne Electric Supply Co., Ltd., to include in its area of electricity supply the parishes of Purley, Sulham and Tidmarsh; the Goring and Streatley Electric Light and Power Co., Ltd., to supply electricity in certain parishes in the rural districts of Goring, Crowmarsh, Bradfield, Wantage and Wallingford; the Chirk Electricity Supply Co., Ltd., to supply parts of the rural districts of Chirk and Oswestry.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Worcestershire and Staffordshire Electric Power Co. to supply electricity in the borough of Ludlow.

Swansea.—SUPPLY FOR DOCKS.—The Electricity Committee is to lay a feeder cable, at a cost of £8,000, to give an additional supply of electricity to the docks of the Great Western Railway Co.

LOAN.—Application is being made for sanction to a loan of £10,000 for meters.

Tiverton.—LOAN.—The Town Council, on February 14th, approved a recommendation of the Lighting Committee that application be made for sanction to borrow £1,650 for an extension of the mains in order to make a complete ring and provide a safety line in case of a mishap to the main feeder.

Truro.—ELECTRICITY SUPPLY.—The City Council has been informed by Messrs. Edmundsons Electricity Corporation, Ltd., that a supply of electricity will be available by next winter.

Tynemouth.—LOANS.—The Electricity Committee is applying for sanction to loans of £16,000 for cable extensions, £2,000 for a sub-station at Cullercoats, £800 for extensions at Preston sub-station, £1,700 for a sub-station at Dock Road, £6,300 for sub-stations and equipment for supply to Commissioners' Dock, and £1,800 for two transformers.

Tramway and Railway Notes.

Bradford.—NEW TRAMCAR DESIGN.—Trials have recently been made with a new type of long, single-deck tramcar, designed by Mr. R. H. Wilkinson, the city tramway manager, and built at the Thornbury depôt workshops. The car is 39 ft. long and capable of a speed of 20 to 30 m.p.h. The exits are in the centre of the car, and the interior furnishing is in polished mahogany, with seats upholstered in red leather. Power operated brakes and doors closed by electric control from the driver's platform form a special feature. The car has seating for 35 passengers.

Continental.—FRANCE.—New electric tramways have recently been completed and put into operation between Lille and Marquette (Nord) and between Marseilles and Les Olives (Bouches-du-Rhône).

GERMANY.—In connection with the work of electrification of the Berlin City railway, which is now in progress, it is announced that the Reich Railway Co. has placed orders for the delivery of aluminium coaches. The coaches will be constructed on behalf of the Metal Bank and Metallurgical Co., which is interested in aluminium rolling mills, in conjunction with wagon construction works.

Darlington.—RAILLESS CARS.—The Rural District Council has granted an application from the Corporation to run railless cars from Park Lane along Geneva Road West subject to any additional cost for road repairs being borne by the Corporation.

India.—RAILWAY BUDGET.—A *Reuter* message from New Delhi states that the Railway Budget for 1927-28, presented in both the Legislative Assembly and the Council of State on February 17th, provides for an expenditure during the year of 25 crores of rupees, of which 275 lakhs has been set aside for the electrification of the Great Indian Peninsula and Bombay, Baroda and Central railways.

London.—UNDERGROUND IMPROVEMENTS.—Experiments are now being made at Earl's Court and South Kensington stations (District Railway) with a new type of train-starting device. Suspended from the roof at one end of each platform are a number of rods linked together with a cable. From this cable two wires are suspended, which connect electrically with a bell at the other end of the platform. When it is desired to start the train, the guard touches the two wires simultaneously with the metal handle of his flag. The circuit formed rings the bell which is near the motorman's cab. If these experiments are successful, the device will be introduced at all other stations between Acton and Bow.

Important structural alterations are now being made at Finsbury Park (Piccadilly line) station, to enable the traffic to be handled with greater ease and also to make the station itself more attractive. The present booking offices are to be cleared away and the passimeter system introduced. Several experiments have recently been made in floodlighting, particularly on the new Morden Tube, where the exteriors of the stations are floodlighted and the positions of the stations emphasised still further by means of searchlights placed on the station roofs. A further experiment of this kind is to be made at the reconstructed Finsbury Park station by substituting for the usual rows of subway lights a scheme of floodlights.

Swansea.—MUMBLES RAILWAY.—The *South Wales Daily Post* states that there is every possibility of an early move being made in connection with the electrification of the Swansea and Mumbles Railway. The Provisional Order has been obtained, and terms have been arranged with the Swansea Corporation for the supply of the necessary electricity. A conference on the matter with the chairman (Mr. Tegetmeier) and the engineer of the company has been arranged, when it is expected some definite steps will be taken.

Telegraph and Telephone Notes.

France.—TELEPHONE SERVICE.—Work has lately been commenced on the conversion of the Colbert telephone exchange in Marseilles to automatic operation.

It is announced that from February 17th Paris will be able to communicate by telephone with Venice, *via* Milan. A six minutes' conversation in the daytime will cost 60 fr., and an urgent call may be booked at triple rates.

Irish Free State.—TELEPHONE CAPITAL BILL.—In Dail Eireann on February 15th the Minister of Finance moved the second reading of the Telephone Capital Bill, under which it is proposed that £500,000 shall be advanced for the development of the telephone service in the Free State. Mr.

J. J. Walsh, Minister for Posts and Telegraphs, said that development fell under four distinct headings, namely:—

Erection of trunk lines	£26,900
New subscribers' connections and call offices	38,600
Underground cable work	111,180
Automatic telephones	123,000

He reminded the Dail that he was not asking for free utilisation of the taxpayers' money; every penny advanced would be paid back, principal and interest, within a period varying from fifteen to twenty years, and a considerable part of the amount asked for would be used for new buildings. In the year 1922-23 the loss was £46,000, in 1923-24 is was £25,000, and in 1924-25 the loss disappeared altogether. In 1925-26 they introduced substantial reductions in charges, and the loss rose to £35,000. He foresaw its total disappearance in 1927-28. They were installing two automatic exchanges in Dublin—one at Merrion and another in the Castle area; the latter would be opened about the middle of the year, and the other early next year. The Bill was read a second time, and the Committee stage was fixed for February 18th, says the *Irish Times*.

Portugal.—AFTERMATH OF REVOLUTION.—The country is returning to normal following the latest revolutionary movement. It is understood that the damage done to the Anglo-Portuguese Telephone Company's property in Lisbon will cost over 200 contos to repair; the company's loss in Oporto is estimated at 50 contos.—*Reuter* (Lisbon).

The rebel chief telephoned his momentous decision over the telephone system, which had continued working, for the telephone girls, like every one in the danger zone, were obliged to stay where they were when the firing broke out, says *The Times*, which announces that public subscriptions have been opened to reward the telephone girls. The British Ambassador has sent a letter of thanks to Mr. Pope, the manager of the telephone system, for the splendid services rendered. It was stated on February 11th that such messages as came through indicated that all the British staffs at Oporto and Lisbon were safe. The Eastern Telegraph Company's station at Carcavellos (at the northern mouth of the Tagus, near Lisbon) was working normally, and a message came through that the staff at the sub-station in Lisbon was safe.

Marconi's Wireless Telegraph Company stated that it was transmitting and receiving messages as usual between its English and Lisbon stations.

Transatlantic Telephony.—SERVICE EXTENSION.—In reply to a question in the House of Commons, the Postmaster-General, Sir W. Mitchell-Thomson, said that the number of telephone calls on the Anglo-American service from January 7th (the date of inauguration of the service) to the end of that month was 105 from Great Britain and 160 from America.

The service has been extended to other parts of this country outside London, whilst the facilities are being steadily extended in the United States, and now cover 36 of the 48 States in the Union. The area served comprises nearly half the territory of the Republic.

Radio Notes.

Denmark.—LICENCES.—It is stated officially that there are now 106,400 licensed Danish listeners: of that number, 54,743 are crystal users and the balance valve-set users.

Italy.—BROADCASTING CONTROL.—The Department of Overseas Trade learns from a reliable source that a Commission for the control of broadcasting services has been set up in Rome by Royal Decree. In addition to control, the Commission is charged with examining and reporting on the most suitable methods of developing and improving broadcasting from technical, artistic, and educative points of view.

Malaya.—NEW REGULATIONS.—The Malayan Wireless Committee recently submitted recommendations regarding radio regulation, which were accepted by the Government. An exclusive broadcasting licence is to be issued for a period of five years to the grantee, who will be chosen from the group of applicants after the expiration of three months from the date of first publication of the terms of the proposed licence. The broadcasting company must, within one year from the date of issue of the licence, install and operate one or more broadcasting stations with machinery of British manufacture of the latest type; renewals and replacements of operating plant need not be of British manufacture. The company must carry out a regular service, consisting of matter approved by the Postmaster-General. It will have the right to disseminate advertising matter and make charges therefor, but such broadcasting must not exceed more than 10 per cent. of the total daily broadcasting time. The Government will charge $20 annual fee for each receiving licence and pay the broadcasting company $18 of this sum.

Philippine Islands.—NEW RADIO LAW.—The Nieto Radio Bill has become a law. In the past broadcasting in the Philippines has been hampered because the stations had no financial support save that obtained from the sale of receiving apparatus, a portion of which accrued to the broadcasting concern. Under the Nieto law, an equitable situation is created whereby every owner of a set helps to support the programmes which he hears, regardless of whether the merchant from whom he purchased his receiver is carrying on broadcasting or not, says *Commerce Reports*. The installation of the former WJZ transmitter at the transmitting centre at Manila Heights is being expedited and should be heard with reliability throughout the archipelago. At the same time improved studio facilities and an adequate staff are being organised.

Suggested New Station.—NORTH WALES PROPOSITION.—At the Ryle Municipal Council's meeting last week, Mr. J. Jones Williams drew attention to the British Broadcasting Corporation's intention to set up a station in North Wales, and suggested Rhyl as the most suitable position for it. During the war, he said, there was a Government wireless station at Rhyl. The Council decided to ask the B.B.C. to locate its proposed North Wales station at Rhyl.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Aberdeen.—March 4th. Parish Council. Re-wiring the electrical installation of Oldmill Hospital. Specifications from Mr. J. Alexander Bell, city electrical engineer.

Ashford.—March 14th. Electricity Department. Two electrically-driven centrifugal pumps (capacity 30,000 gal. per hour). (See this issue.)

Australia.—MELBOURNE.—April 5th. Postmaster-General's Department. Condensers. (B.X. 3215.)*
March 30th. Victorian Railways. Lightning arresters. (B.X. 3213.)*
April 26th. Telephone switches. (B.X. 3254.)* Instrument cords. (B.X. 3255.)*
BRISBANE.—April 13th. Brisbane City Electric Light Co., Ltd. Transformers. (B.X. 3218.)*

Bedford. — February 28th. Electricity Department. Twelve months' supplies of e.h.p. and l.p. cables and incandescent electric lamps. (February 11th.)

Belgium.—March 9th. Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels. 40 kilometres of silk-covered enamelled wire, 25 kilometres of specially-insulated wire, and 4.6 kilometres of armoured wire cable.

Brecon.—March 16th. Electricity Department. Generating plant and switchgear, battery of accumulators and connections, underground and overhead lines. (See this issue.)

Bridlington. — March 9th. Electricity Department. Stores for 12 months, including lamps, electrical sundries, V.I.R. cables, &c. (See this issue.)

Cheadle and Gatley.—March 1st. Electricity Department. Annual contracts for lamps, meters, and wood covering boards. (February 18th.)

Colwyn Bay.—March 11th. Electricity Department. Twelve months' supply of cables, joint boxes, house service cut-outs, joint compound, sundry stores, house service meters. (See this issue.)

Dublin.—March 2nd. Great Northern Railway (Ireland). Stores for nine months, including electrical fittings, lamps, cable and wire. (February 18th.)
March 2nd. Office of Public Works. Installation of electric lighting at the Custom House, Dublin. Mr. T. Cassidy, secretary.

Dundee.—February 28th. Education Committee. Electrical installation for the new secondary school, Perth Road. Messrs. Thoms & Wilkie, architects, 21, South Tay Street, Dundee.

Durham (Co.).—March 12th. County Council. Electrical work for the Seaham Hall tuberculosis hospital. W. and T. R. Milburn, architects, 19, Fawcett Street, Sunderland.

Edinburgh.—Corporation. Supplies in connection with the maintenance of the Corporation properties, including supplies for the Lighting Department, &c. Form from Town Clerk.

Egypt.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen's Anne's Chambers, Broadway, Westminster, S.W.1. Telegraph and telephone materials.

Ilford.—March 8th. Electricity Department. Twelve months' supply of house-service boxes, lamps, main cut-outs, meters, and pavement box covers. (See this issue.)

India.—March 22nd. India Store Department. Two 250-kW Diesel-engine alternator sets, with switchgear, transformer, &c. (February 18th.)

Leeds.—March 2nd. Tramways and Transport Committee. Materials, including electrical sundries required during year ended March 31st, 1928. General manager.

London.—STEPNEY.—March 3rd. Board of Guardians. Electrical fittings for 6 months. Mr. S. McClelland, clerk to the Guardians, Bancroft Road, Mile End, E.1.

Littlehampton.—March 8th. Sussex Electricity Supply Co., Ltd. One 150-kW Diesel engine and generator with auxiliaries, switchgear and cables. (February 18th.)

Oldham.—March 7th. Board of Guardians. Electric lamps and fittings. Mr. Fred. W. Fletcher, clerk.

Rhondda.—March 26th. Electricity Department. Twelve months' supply a.c. ordinary and prepayment meters, mains and house service material. (See this issue.)

Roxburgh.—March 5th. County Education Authority. Electrical work in connection with the reconstruction of and additions to High School, Hawick. Mr. J. A. Carfrae, architect, 3, Queen Street, Edinburgh.

South Africa.—JOHANNESBURG.—March 3rd. South African Railways and Harbours. Overhead line material. (B.X. 3224.)*

March 19th. Municipal Council. Single-phase concentric cable. (B.X. 3236.)*

CAPE TOWN.—March 9th. Electricity Department. Insulated wire. (B.X. 3233.)*

South Elmsall.—March 19th. Electric lighting installation at Westfield Lane Council School. Education Department, County Hall, Wakefield.

Stoke-on-Trent.—March 8th. Electricity Department. De-aerating plant and electrically-driven boiler-feed pumps. (February 18th.)

March 8th. Electricity Department. Twelve months' supply a.c. and d.c. meters, mains and cables. (See this issue.)

Torquay.—March 11th. Electricity Department. Two water-tube boilers with chain-grate stokers, induced draught plant, pipework and economisers. (February 18th.)

March 16th. Electricity Undertaking. One 6,000-kW turbo-alternator, with surface condenser and auxiliary plant. (See this issue.)

Warrington.—March 14th. Electricity Department. Motors and transformers. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bangor.—Corporation.
Wiring 64 houses on the J. & P. wiring system.—Messrs. Owen & Palmer, Bangor.

Bradford.—Electricity Committee. Accepted:—
Water-softening plant at the Valley Road generating station.—Paterson Engineering Co., Ltd.

Chesterfield.—Electricity Committee. Accepted:—
E.h.p. metering switch cubicle.—British Thomson-Houston Co., Ltd.
One steam-driven boiler feed pump.—T. W. Ward, Ltd.
L.p. cables (£312).—Hogan & Wardrop, Ltd.
E.h.p. cables (£372).—Macintosh Cable Co., Ltd.

Clacton.—Urban District Council. Accepted:—
Two 1,125-b.h.p. oil engines (£20,500); two 750-kW alternators (£3,250).—English Electric Co., Ltd.
Rotary convertors and e.h.p. switchgear (£5,250).—Crompton & Co., Ltd.

Clydebank.—Town Council.
Housing scheme.—Supplying and fitting electric radiators (£3 6s. 11d. each).—D. Donald.

Croydon.—Electricity Committee. Recommended:—
Switchgear (£3,145).—Metropolitan-Vickers Electrical Co., Ltd.

Dublin.—Dublin United Tramways Co., Ltd.
Electric lamps, including 8,000 " Osram " vacuum traction lamps.—General Electric Co., Ltd.

City Commissioners.
Wiring for electric lighting 59 four-roomed houses at Fairbrother's Field (£616).—Electricity Supply Department.

Controller of Stores, Posts and Telegraphs.
Bell sets.—Siemens Bros. & Co., Ltd.
Coin boxes (telephone).—Hall Telephone & Accessories, Ltd.
Insulators.—Doulton & Co., Ltd.
Telephone relays and coils.—Siemens Bros. & Co., Ltd.
Wireless parts.—Marconi's Wireless Telegraph Co., Ltd.
—*Irish Electrician.*

Durham.—Board of Guardians. Accepted:—
Electric lighting installation at the new Cottage Homes (£103).—Mr. R. Wilson.

Evesham.—Town Council. Accepted:—
Installing electric lighting at the baths.—Averill & Son.

Glasgow.—Electricity Committee. Recommended:—
Sub-station switchgear (£239).—A. Reyrolle & Co., Ltd.; also further sub-station switchgear during the year at the same price per set.
Two preheaters for two boilers at Dalmarnock power station (£5,800).—Howden-Ljungström Preheaters (Land), Ltd.

Libraries Committee. Recommended:—
Alteration and repair of passenger hoist at Mitchell Library (£210).—Waygood-Otis, Ltd.

Tramways Committee. Accepted:—
Block tin.—P. W. MacLellan, Ltd.
Subway rails.—W. Beardmore & Co., Ltd.

Special Acts Committee. Accepted:—
Electric lighting installation at Eastwood Registration Office.—C. Maguire (Glasgow).

Government Contracts.—The following contracts were placed by various Government Departments during January, 1927:—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.
Alternators, motors and spares.—Mackie & Co.
Aluminium plating for cables.—British Aluminium Co., Ltd.; G. A. Harvey & Co. (London), Ltd.; Bulpitt and Sons, Ltd.
Aluminium sheets.—British Aluminium Co., Ltd.
Batteries.—Chloride Electrical Storage Co., Ltd.; D.P. Battery Co., Ltd.
Junction boxes.—L. Weekes (Luton), Ltd.; Hawkers, Ltd.
Electric cable.—Anchor Cable Co., Ltd.; General Electric Co., Ltd.; Enfield Cable Works, Ltd.; Siemens Bros. & Co., Ltd.
Mining cable.—Hooper's Telegraph & India Rubber Works, Ltd.; Siemens Bros. & Co., Ltd.
Cells.—Premier Accumulator Co. (1921), Ltd.; London Battery & Cable Co., Ltd.
Electric fan spares.—General Electric Co., Ltd.
Fuse holders.—Pinnacle Switchgear, Ltd.
Motor-generator set.—British Thomson-Houston Co., Ltd.
Motor generators.—Newton Bros. (Derby), Ltd.; Laurence Scott & Co., Ltd.
Heterodyne and stabiliser units.—Radio Instruments, Ltd.
Electric light and bell installation and installation of electric light and power.—G. E. Taylor & Co.
Electric lamps.—General Electric Co., Ltd.
3,000-kW turbo-alternator.—C. A. Parsons & Co., Ltd.
W./t. valves.—Mullard Radio Valve Co., Ltd.

WAR OFFICE.
Aluminium ingot.—British Aluminium Co., Ltd.
Electric cables.—Standard Telephones & Cables, Ltd.
Portable secondary cells.—Tudor Accumulator Co., Ltd.
5-kW frequency changer.—Newton Bros. (Derby), Ltd.
Electric locomotive.—Electromobile, Ltd.
X-ray sets.—" Solus " Electrical Co.
Installation of electric cable system, Smallshot.—Standard Telephones & Cables, Ltd.
Installation of electrical services, officers' quarters, &c.—A. V. Gifkins & Co., Ltd.

AIR MINISTRY.
Wireless towers (various stations).—Milliken Bros., Ltd.
Alternator set (Croydon).—Aster Engineering Co. (1913), Ltd.
Control resistance and voltmeters.—British Radio Corporation, Ltd.

POST OFFICE.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Peel-Conner Telephone Works; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.

Wireless apparatus.—General Electric Co., Ltd.; Marconi's Wireless Telegraph Co., Ltd.
Telephone cabinets.—Siemens Bros. & Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Connolly's (Blackley), Ltd.; W. Geipel, Ltd.; W. T. Glover and Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Pirelli-General Cable Works, Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Loading coils.—General Electric Co., Ltd.
Cords for telephones.—London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Standard Telephones & Cables, Ltd.
Ducts.—J. Place & Sons, Ltd.; Standard Brick & Terra Cotta Co., Ltd.
Electric hand lamps.—Ward & Goldstone, Ltd.
Telegraphic ironwork.—J. H. Allen; Bert, Birks & Co.; Bullers, Ltd.; T. W. Lench, Ltd.; C. Richards and Sons, Ltd.
Cadmium copper wire.—R. Johnson & Nephew, Ltd.
Manufacture, supply, drawing-in and jointing cable.—Godalming-Haslemere: Johnson & Phillips, Ltd. Hull - Grimsby, G.P.O.(S) - Wallington Junction: Standard Telephones & Cables, Ltd. Bristol-Temple Cloud: Pirelli-General Cable Works, Ltd. London—Amersham (London-Chorley Wood section): W. T. Henley's Telegraph Works Co., Ltd.
Manufacture, supply and laying submarine cable.—Portsmouth-Gosport: Pirelli-General Cable Works, Ltd.
Telephone exchange equipment.—Wandsworth, Wimbledon and Epsom Gas Co., Ltd.; Royal Arsenal Co-operative Society, Ltd., (S.E.18); Spillers & Bakers, Ltd. (Cardiff); John Player & Sons (Nottingham); Dorset County Council (Dorchester): Relay Automatic Telephone Co., Ltd. Middlesbrough (Middlesbrough multi-office area), Stockton-on-Tees: General Electric Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; Crompton and Co., Ltd., for machine plant. Linthorpe (Middlesbrough multi-office area) and Southbank (ditto): General Electric Co., Ltd. Sub-contractors: W. Jones and Co. for ringing machines. Horley (Surrey): General Electric Co., Ltd. Sherwood (Nottingham), Arkwright Street (ditto), and Malvern: Automatic Telephone Mfg. Co., Ltd. Walsall (Walsall multi-exchange area): Ericsson Telephones, Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., for machine plant. Bloxwich (Walsall multi-exchange area): Ericsson Telephones, Ltd. Sub-contractors: Automatic Telephone Mfg. Co., Ltd., for ringing machine. Bath (Bath multi-office area): Ericsson Telephones, Ltd. Sub-contractors: D.P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., and General Electric Co., Ltd., for machine plant. Batheaston (ditto): Ericsson Telephones, Ltd. Sub-contractors: Automatic Telephone Mfg. Co., Ltd., for ringing machines. Bermondsey: Standard Telephones & Cables, Ltd. Sub-contractors: Electric Construction Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines; and D.P. Battery Co., Ltd., for batteries.
Telephone repeater station power plant.—Marks Tey: Newton Bros. (Derby), Ltd. Sub-contractors: Pritchett & Gold & E.P.S. Co., Ltd., for batteries; Ruston and Hornsby, Ltd., for engines.
2-wire repeater equipment for Canterbury telephone repeater station.—General Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Fuse mountings.—Telephone Mfg. Co., Ltd.
"Lux" cells.—Chloride Electrical Storage Co., Ltd.
Telephone apparatus.—Ericsson Telephones, Ltd.; Bullers, Ltd.; Peel-Conner Telephone Works.
Train-lighting spares.—Pritchett & Gold & E.P.S. Co., Ltd.; J. Stone & Co., Ltd.
Wire.—F. Smith & Co., Ltd.
X-ray equipment.—Watson & Sons, Ltd.

H.M. OFFICE OF WORKS.

Wiring Adastral House, Kingsway, W.C.—J. G. Briggs and Co.

Hornsey.—CORRECTION.—The names of the contractors for the electric lighting installation at the Council houses, recorded on page 181 of the February 4th issue are Messrs. E. Wight & Co., of Muswell Hill and Finchley (not Wright and Co.).

Liverpool.—Pacific Steam Navigation Co., Ltd.
Twelve months' supply of "Mazda" electric lamps.—British Thomson-Houston Co., Ltd.

London.—LONDON, MIDLAND & SCOTTISH RAILWAY CO.
"Cosmos" vacuum train-lighting lamps.—Metro-Vick Supplies, Ltd.

ADMIRALTY.

Spring contact pieces, rotary switches, and guards for handlamps.—Edison Swan Electric Co., Ltd.

LONDON COUNTY COUNCIL.—Wiring of three blocks of dwellings on the Hornsey Rise estate for electric light:—

A. Shaw	£1,267†
R. Hunt & Co., Ltd. (Accepted.)	**1,375**
Austin & Groves	1,573†
Alpha Mfg. & Electrical Co., Ltd.	1,619
Alex. Hawkins & Sons	1,739
A. Higginbotham & Sons	1,772
C. Mortlock	1,885
D. W. Whymant	1,887
Anderson, Angell & Co.	1,954
Eastern Armature Winding Co.	2,025
Bailey & Incledon, Ltd.	2,159
Smethurst & Co. (London), Ltd.	2,463
Holder & Snider	2,568
E. Wight & Co.	2,816
General Electric Maintenance Co.	3,860

† Tender does not include provision money (£160).

STEPNEY.—Electricity Supply Committee.
3 tons sheet lead (£111).—Locke, Lancaster & Johnson and Sons, Ltd. (Accepted.)
Maximum demand indicators (£7,358).—Reason Mfg. Co., Ltd. (Recommended.)

HACKNEY.—Baths Committee.
Extension of filtration plant at the Central Public Baths, complete with electric motors, switchgear, &c. (£3,745).—Bell Bros. (Manchester), Ltd. (Recommended.)

SOUTHERN RAILWAY. Accepted:—
Six months' supply of electric lamps.—British Thomson-Houston Co., Ltd.; Siemens & English Electric Lamp Co., Ltd.

ISLINGTON.—Lighting Committee. Recommended:—
Steam mechanical soot blowers (£2,650).—Babcock & Wilcox, Ltd.

Works Committee. Recommended:—
Battery for electric vehicle (£182).—Chloride Electrical Storage Co., Ltd.

WESTMINSTER.—Highways Committee. Recommended:—
Dustproof-type electric motor for salvage plant (£96).—Elliston, Evans & Jackson, Ltd.

Macclesfield.—Rural Council. Accepted:—
Installing an electric generating set in connection with the Gawsworth housing scheme (£736).—W. R. Brown.

Newcastle.—Tramways Committee. Accepted:—
200 tons of tram rails and 8 tons of fish plates (£2,191).—Cargo Fleet Iron Co., Ltd.

Rotherham.—Rural Council. Accepted:—
Installing electric lighting in 51 houses at Brampton Bierlow (£260).—Wombwell Electrical Contracting Co.

Southend-on-Sea.—Town Council. Accepted:—
11,000-V. h.p. mains, pilot and control cable for the linking-up of the Leigh, London Road, and Thorpe Bay stations (£28,479).—Pirelli-General Cable Works, Ltd.

Forthcoming Events.

British Industries Fair.—February 21st to March 4th. White City, London, W., and Castle Bromwich Aerodrome, Birmingham.

Institution of Engineering Inspection.—Friday, February 25th. Royal Society of Arts. 7.30 p.m. "The Economic Production of Steam by Electricity." Mr. C. J. Wharton.

Birmingham Electric Club.—Friday, February 25th. Grand Hotel. 7 p.m. "Wireless Telephony." Mr. C. G. A. McDonald.

Institution of Mechanical Engineers.—Friday, February 25th. London. 7 p.m. "Waste Heat Recovery." Major W. Gregson.

Physical Society.—Friday, February 25th. Imperial College of Science, South Kensington, S.W. 5 p.m. Guthrie Lecture, "Atomic Nuclei and their Transformations." Sir Ernest Rutherford, F.R.S.

National Association of Supervising Electricians.—Saturday, February 26th. Holborn Restaurant. 6.30 p.m. Annual dinner.
Tuesday, March 1st. Junior Institution of Engineers. 7.15 p.m. "Electric Lighting and Electrically-worked Apparatus on Railways." Mr. R. T. Smith.

Royal Society of Arts.—Monday, February 28th. "Photo-Elastic Measurements of Stress Distribution." Prof. E. G. Coker, F.R.S.

Electrical Society of Glasgow.—Tuesday, March 1st. 30, Gordon Street. 7.30 p.m. "Reminiscences." Messrs. C. W. Fraser, D. Denholm, W. Bennett, and P. J. Sims.

Röntgen Society.—Tuesday, March 1st. 32, Welbeck Street, W. 8.15 p.m. Ordinary scientific meeting.

Electrical Power Engineers' Association (Midland Division).—Tuesday, March 1st. Chamber of Commerce, Birmingham. 7 p.m. "Super-Tension Cables." Mr. C. Vernier.

(Southern Division).—Friday, March 4th. Institution of Electrical Engineers, London. 7 p.m. "The Installation and Maintenance of e.h.p. Cable." Mr. E. Bowden.

Institution of Heating and Ventilating Engineers.—Wednesday, March 2nd. Caxton Hall, S.W. 7 p.m. Discussion on Dr. Margaret Fishenden's paper, "The Effect of Weather Conditions upon the Heat Requirements of a House."

Edinburgh Electrical Society.—Thursday, March 3rd. Royal Scottish Society of Art. 8 p.m. "Electro-Medical Equipment." Mr. W. Rennie.

Institution of Electrical Engineers.—Thursday, March 3rd. London. 6 p.m. "Illuminating Engineering." Mr. J. W. T. Walsh; and "Problems of Public Lighting by Electricity." Mr. H. T. Harrison.

(North-Eastern Centre).—Monday, February 28th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Some Recent Advances in a.c. Measuring Instruments." Lt.-Col. K. Edgcumbe and Mr. F. E. J. Ockenden.

(Irish Centre (Dublin)).—Tuesday, March 1st. Mansion House, Dublin. 7.45 p.m. Faraday Lecture, "What is Electricity?" Prof. W. M. Thornton.

(Tees-Side Sub-Centre).—Monday, February 28th. Middlesbrough. 7 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(East-Midland Sub-Centre).—Tuesday, March 1st. University College, Nottingham. 6.45 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(Wireless Section).—Wednesday, March 2nd. London. 6 p.m. "Short-Wave Wireless Telegraphy." Mr. T. L. Eckersley.

(South-Midland Students' Section).—Tuesday, March 1st. 7 p.m. Ordinary meeting.

(North-Western Students' Section).—Saturday, March 5th. Manchester Municipal College of Technology. 7 p.m. Dance.

Junior Institution of Engineers.—Friday, March 4th. 39, Victoria Street, S.W. 7.30 p.m. Informal meeting. "An Evening with the Old Brigade."
Saturday, March 5th. Suffolk Street Galleries. 6.30 p.m. Annual dance.

Notes.

Glasgow Corporation Tramway Supply Account.

A joint meeting of sub-committees of the Glasgow Electricity and Tramways Committees was held recently to consider the price of electricity supplied during the coal dispute. It was recommended that the claim of £1,146 for the extra cost of coal for electricity supplied during June and July be reduced to one-half, and that the account for the other months, amounting to £7,596, be paid in full. The account to be paid by the Tramways Department to the Electricity Department will accordingly be £8,169.

Train Accident Report.

We have received a copy of the official report of the inquiry into the circumstances of an accident which occurred on October 12th last between Charing Cross and Waterloo Junction, on the Southern Railway, when a passenger train from Charing Cross was partially derailed at the facing points of the through crossing from the down through line to the down local lines. The section of the line had recently been equipped throughout with modern all-electric apparatus by the Westinghouse Brake & Saxby Signal Co. The accident was curious in that it was the outcome of the combination of a failure in the locking of the points and a signalman's error in pulling a control lever too soon, resulting in the derailment of the train.

American Drawn Tungsten Patent Held Invalid.

It will be remembered that in 1925 the House of Lords held in the case the British Thomson-Houston Co., Ltd., *v.* British Insulated & Helsby Cables, Ltd., that the British patent owned by the plaintiffs relating to improvements in the treatment of tungsten to facilitate working was invalid. The Lords of Appeal decided that the production of tungsten which was ductile when cold was more the result of advances in the metal-worker's art than of any discovery. The judgment was given in full in our issue of February 13th, 1925 (p. 279).
The parallel United States patent was recently invalidated by a decision of the United States District Court for Delaware. According to an *Electrical World* report, the General Electric Co. (of America) brought an action against the De Forest Radio Co. charging it with contributory infringement of its patent for improvements in tungsten and methods of making tungsten for lamps and other purposes. The plaintiffs also brought suits against the De Forest Co. and the Robelin Piano Co. for infringement of certain product claims of the patent. The acts charged were the manufacture and sale of radio valves having ductile tungsten filaments made by an alleged infringing manufacture of drawn tungsten wire and the re-sale of the valves by the Robelin Piano Co. The defendants contended that the claims made were invalid. The product claims were attacked for want of patentable subject matter, in that they called for a product of nature, that the raw material to which the process was applied and the product resulting from that process were alike, the element tungsten, and that the properties of the product, like those of the original body, were discovered natural, not invented artificial properties. The plaintiffs did not deny that a wire or rod of a prior patent was a coherent mass of tungsten and as such the starting body called for by their patent, but averred that until Dr. W. D. Coolidge, the inventor named in the patent, did his work and accomplished his results it was not known that the prior rod constituted a suitable starting body. The claims in the suit called for tungsten that was pliable or ductile at room temperature, and one problem involved in the trial was to determine whether ductility was a natural or an artificial property of tungsten, whether tungsten ductile cold was a "manufacture" or a product of nature, and whether a single element of nature not patentable before mechanical treatment might be made patentable by subjecting it to mechanical treatment. The Court held that invention involved not only mental conception but manual application, and the discovery of the cold ductility of tungsten was not patentable.

The Batti-Wallahs' Society.

The Batti-Wallahs' annual dinner is to take place at the Hotel Cecil on Tuesday, March 22nd, at 7 p.m., and will be followed by dancing till midnight; it is intended to make this the occasion for celebrating the 21st birthday of the Society. Ladies and gentlemen friends of members will be welcome, and tickets may be obtained from the members of the Council or from the hon. secretary, Mr. M. Whitgift, 7, Coulter Road, Hammersmith, W.6.

On Wednesday last week, at the Hotel Cecil, with the president, Mr. A. W. Blake, in the chair, the Society entertained at luncheon Sir Duncan Watson. After the loyal toast had been honoured, Sir Duncan addressed the members, concisely reviewing the past, present, and future of the electricity supply industry. Referring to the chaotic state of things that obtained 25 years ago, he expressed the views that the incursion of the municipalities into electricity supply had been of immense value, and that full co-operation between private and public enterprise was most important. By reducing the cost of electricity, he said, the Government scheme would increase the demand; the Act was not perfect, but could be amended, and in the meantime it should be given a fair trial. In his view they were on the threshold of the greatest electrical development this country had ever known.

Lecture.

Mr. F. Farrar, A.M.I.E.E., gave a lecture with demonstrations at a meeting of the Walsall Engineering Society last week, on "Some Applications of Electricity." At the conclusion of the lecture the president of the Society, Mr. W. J. Talbot, said that the Talbot-Stead Tube Works, with which he was associated, now employed about 150 electric motors, and their experience had been that electricity was the cheapest medium for power in the long run. They had found that the total cost of energy was only 2 per cent. of the whole. He warned manufacturers, however, not to think that electricity was going to revolutionise everything, or compensate for inefficiency in other directions.

Spinning Electrons and Protons.

Writing to *Nature* of February 12th, Mr. H. S. Allen says: "The remarkable results obtained within the past 15 months by employing the spinning electron in Bohr's atomic model suggest the question whether it may not be necessary to suppose that the proton also is capable of a quantised spin. Although the analytical difficulties in applying the new quantum mechanics to this problem may be considerable, they may not be too great to be overcome by mathematicians. There seem to be several arguments in favour of such a hypothesis. If, as is generally assumed, the proton is the positive electron, it seems natural to suppose that if the negative electron can spin with unit angular momentum the positive electron may do the same. Again, it may be easier to understand the structure of a complex nucleus if the units of which it is composed can act as elementary magnets. Prof. Duane has attempted to explain corpuscular emission from a radioactive nucleus on these lines. Finally, recent experiments on the deflection of protons and alpha particles in collision with an atomic nucleus seem to lend support to the idea of a magnetic field in the vicinity of a nucleus. A spinning electron is one example of a *magneton*. My main object in this letter is to remind readers of *Nature* that a quantised magneton was first described in these columns by Prof. S. B. McLaren, a victim of the war."

E.P.E.A. Dinner.

The third annual dinner of the North-West Midland Section of the Electrical Power Engineers' Association was held at the "Star and Garter" Hotel, Wolverhampton, on February 15th. The chairman was Mr. D. J. Duffy, Wolverhampton, and many distinguished persons were present.

Viscount Ednam, in proposing "The E.P.E.A.," said the Association protected not only its members, but the public also. If other trade unions had behaved in the same way as the E.P.E.A., there would have been no need for the squabble on the subject in the House of Commons. He said that no better principle could be embodied in the rules of any association than that of negotiation under the Whitley system. During a recent visit to America he was impressed by the fact that in Milwaukee they distributed more electricity than in the whole of the City of London. He wanted enough cheap power to run his steelworks and collieries, but he found it was cheaper to generate his own supply. During the general strike he saw some fuel being put into boats from a certain mound, and on inquiry found that the pit had ceased working in 1785; the slack went to a power station, where it was burnt all right. Referring to the Government scheme, he said that if Colonel Moore Brabazon had faith in it, then it must be a good one.

Mr. J. N. Waite, vice-president, in reply, said that for the Association and its members to be prosperous, it was first of all necessary for the industry itself to be in a thriving and prosperous state, as one could not take from an industry that which was not there. He reminded Lord Ednam that the most efficient turbo-generators in the U.S.A. had been made in this country.

Colonel J. F. Lister, C.M.G., proposed "The West Midlands Joint Electricity Authority." He related some of his experiences in a power station in the early days, and referred to the development which was to take place by the interlinking of certain stations. He referred also to the backwardness of this country in the distribution of electricity in rural areas, citing instances on the Continent and in Egypt, where he had come across the most uneducated type of workman operating motors and other gear. He made a plea to all connected with the authorities now being set up in this country to do their best to see that the poles for carrying the h.p. cables in the rural areas would not only be serviceable, but as artistic and pleasing as possible compatible with reasonable cost.

Mr. S. T. Allen, chief engineer and manager of the West Midlands Joint Electricity Authority, replied, and gave a *résumé* of the spadework which had been done in the Midlands during the last six months. He impressed on the members of the Association the great responsibility which was not only on his shoulders, but would be in the very near future on the shoulders of most of the technical staffs represented at the dinner, when the individual stations in the district were taken over by his authority. The total expenditure on the schemes would reach £3,500,000.

Mr. T. A. G. Margary very ably proposed the toast of "The Visitors," to which Mr. G. R. J. Parkinson, vice-chairman of the West Midlands Joint Electricity Authority, responded in a brief but humorous and well-balanced speech.

Electric Locomotives in Switzerland.

The Oerlikon Company is at present building for the Swiss Federal Railways 18 heavy goods locomotives, which differ from those formerly supplied in that they are designed for a larger output. In order to determine the heating of the motor equipments and ascertain their output, one of the motors was provided with thermo-couples and subjected to a series of load tests, the thermo-couples being arranged as near as possible to the conductors of the stator and rotor windings. The results of the tests are given in the following table:—

	Continuous rating			One-hour rating		
	Amps.	kW.	r.p.m.	Amps.	kW.	r.p.m
Data for calculation of motor ...	1,400	435	620	1,600	485	555
Performance on test: (A) with temperature rise according to the regulations of the Swiss Federal Railways.	1,550	480	560	1,730	530	530
(B) with temperature rise according to the American Rules.	1,780	545	520	2,070	610	480

The pressure of all the tests was 360 volts: the tests showed that the motors would even be large enough for the express locomotives recently standardised by the Swiss Federal Railways, as the temperature rise would then be still just within the permissible limit. The speeds of the goods engines at the one-hour and continuous ratings (41 and 40.5 m.p.h., respectively) actually correspond to those provided for in the case of the express locomotives. The highest normal motor speed of 1,030 r.p.m. is, however, only attained at 74.5 m.p.h. by the express locomotive, while it is reached at 40.5 m.p.h. by the goods engines.

Meter Engineers' Technical Association.

The sixth general meeting of this Association was held at the E.L.M.A. Lighting Service Bureau, London, on February 17th, when the chair was taken by Mr. C. H. W. Gerhardi, and a paper was read by Mr. C. W. Pike on "Meter Testing Methods and their Relationship to Output and Accuracy." The discussion was opened by Mr. H. R. Burroughs, who feared that many meter engineers were unable to carry out tests to a great degree of precision. In referring to the sustained accuracy of meters in service, he instanced the case of a large meter recently installed agreeing to within 2 per cent. with the sum of 9 sub-meters which had been on circuit for 20 years.

Mr. S. Hunt did not agree with the suggestion for using a sub-standard meter with a range of shunts; nor with the total abolition of an observer, especially in the case of large meters. His department had no difficulty in testing from 200 to 250 meters per week, the large majority of which he was able to certify as "O.K." Regarding the question of hysteresis, although it had caused considerable inaccuracies in old type meters, he had found no trouble due to this cause in those of recent manufacture.

Mr. W. Casson did not agree that meter engineers should not endeavour to obtain as high a degree of accuracy with integrating sub-standards as with indicating instruments. He suggested that the remedy for inaccuracies due to wave form was to use meters which one knew by experience to be unaffected. He contended that no commutator meter should be used in this country as a sub-standard, as, owing to climatic conditions, its friction would be too uncertain.

Mr. C. B. Green was of the opinion that the "personal error" was practically eliminated when the tester had confidence in himself, and cited the work of the N.P.L. as an example of accuracy obtainable with the use of the stop-watch and potentiometer method of testing.

Mr. R. P. Bossom described the method of testing electrolytic meters by copper voltameters, and stated that these agreed to within ¼ per cent. with the results obtained by potentiometer.

Royal and Whitworth Scholarships.

The Board of Education has recently issued the syllabus for the examination to be held in April and May, 1928, for Royal scholarships and free studentships in science, tenable at the Imperial College of Science and Technology, London, and also the regulations for the award of Whitworth scholarships for mechanical science in 1928. These and full details of the scholarships are obtainable from H.M. stationery office.

Leader Cable for Aircraft.

Fog flying experiments with the leader cable system, as stated in *The Times*, are now in progress at the Royal Aircraft Establishment, Farnborough, and the scheme is now being tried on a large scale in the Woking-Basingstoke area with five miles of cable laid in the form of an oval within the aerodrome. Two sides of the oval are nearly straight, and along one of them is an auxiliary cable giving a signal of a different frequency. This indicates the area around which a landing can be made with the greatest ease. The aircraft is fitted with two search coils in the wings connected with an instrument in the cockpit, which tells the pilot, by means of oscillating lights on vertical scales, whether he is to port or starboard of the cable. The newer instruments have enabled the amperage to be reduced to 50, the horsepower to 3 per mile, and they are sensitive to signals from a height of 1,500 ft. downwards; they are, in fact, so delicate that they respond to a signal of 0.0005 microwatt.

Television.

Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Co. of America and the Radio Corporation of America, who has devoted a great deal of time to telephotography and television, declares that "our work has already proved that the expectation of television is not unreasonable, and it may be accomplished with means that are in our possession at the present day. How long it will take us to attain practical television I do not venture to say." The radio transmission of a single photograph has been accomplished, but television will require the transmission, reception, and reproduction of a single picture in one-sixteenth of a second, and one of the fundamental difficulties is the development of a projector which will enable one to see on a screen the movement of objects miles away. "It is easy enough to design a television system with something like 40,000 picture units per second," states Dr. Alexanderson, "but the images so obtained are so crude that they have no practical value; an operating speed of 300,000 picture units per second will be needed to give pleasing results." The method devised to speed up the process is the use of seven distinct light sources, converging in a cluster which scans the picture, all seven interlacing optically to produce a single good picture. The model projector used by Dr. Alexanderson consists of seven light sources converged by an optical system on to a revolving drum carrying 24 mirrors, which reflect the light cluster on to a screen. The useful illumination is thus increased 49 times, and the speed at which each light beam must travel has been reduced at the rate of 7 to 1; in addition to these advantages each beam needs to move only one-seventh as fast, and therefore needs to give only 43,000 instead of 300,000 independent impressions per second. A modulation speed of 43,000 per second is high in present radio practice, but is within reason, being only 10 times as fast as that used in broadcasting. For the independent control of the seven light spots seven photo-electric cells are located in a cluster at the transmitting machine and control a multiplex radio system with seven channels. A Hammond multiplex system may

be used with seven intermediate carrier waves which are "scrambled" and sent out by a single transmitter, and then "unscrambled" at the receiving station so that each controls one of the seven light beams. Dr. Alexanderson has radio-transmitted pictures by means of both modulated and interrupted signals: with the former system, any broadcasting station can transmit photographs for distances as great as music of good quality can be transmitted by that station; for long-distance transmission the short-wave telegraph system may be used. Reception of pictures by telegraphy is independent of signal strength; thus, if the signal is strong enough to be recorded at all, it gives the same kind of records at maximum as at minimum signal intensity, which makes recording independent of fading. If, furthermore, the signals are stronger than the prevailing static, it is possible to eliminate static effects by introducing a "threshold" value of signal strength in the receiver so that nothing is received unless the signal exceeds this value.

National Union of Scientific Workers.

This union, which was founded in 1918 to promote the cause of science in our national life and to improve the status of the scientific worker, has not succeeded in becoming a fully representative organisation, its membership being a little below 1,000, although there must be some 10,000 persons eligible for membership. An appeal has therefore been issued this week to all qualified scientific workers in this country, inviting an expression of their views on the possibility and desirability of building up a body fully representative of their broader interests. It is signed by a large number of brilliant lights of the scientific and industrial world—including Sir W. H. Bragg, Dr. W. H. Eccles, Sir Richard Gregory, Sir Robert Hadfield, Sir Hugo Hirst, Sir Thomas Holland, Sir Max Muspratt, Sir Charles Parsons, Prof. J. S. Huxley (president), Prof. H. L. Callendar, Dr. Norman R. Campbell, Dr. Ezer Griffiths, Prof. C. F. Jenkin, Prof. E. W. Marchant, Mr. C. C. Paterson, and over 100 other eminent supporters, covering the whole field of science and technology.

The Union is entirely non-political, and has been successful in bringing about improvements in the conditions of service of groups of scientific workers in Government and private employ; if it could speak for a united profession its activities could be extended and its influence could be exercised effectively in the interests of research, training, and other national services, without trespassing on the sphere of any existing organisation. In view of a misconception that exists in some quarters, it is pointed out that the strike is not a possible weapon for scientific workers, and the Union has never imagined the possibility of its employment.

The present rate of subscription is 30s. per annum, but if the membership were considerably increased it should be possible to reduce the subscription to about 10s. The present appeal is not for membership, but for the views of those interested, for the guidance of the Council; readers can obtain particulars from the Secretary, 25, Victoria Street, S.W.1.

Appointments Vacant.

Charge engineer for the Singapore, Straits Settlements, Municipal Electricity Department. Distribution engineer (£456) for the Torquay electricity undertaking. Chief engineer and general manager for the Altrincham Electric Supply, Ltd. Chief clerk (£217) for the Borough of Colne Electricity and Tramway Department. Foreman winder for fans and small motors, for the Rangoon Electric Tramway and Supply Co., Ltd. (See our advertisement pages to-day.)

Mansfield Electricity Investigation.

The concluding stage of the investigations into the affairs of the Mansfield Corporation electricity undertaking, consequent upon the appointment of a special committee of investigation twelve months ago, following certain statements that were made in the Council Chamber, was reached recently when a special meeting of the Council was held to receive the report and findings of the committee.

The statements made with reference to the management of the Electricity Department were to the effect that lengths of cable attached to drums and representing a considerable outlay in money were lying in different parts of the town; that many yards of cable had been laid at great cost, and in some cases were still dead, and in others supplied very few consumers; that mistakes had been made by the engineer in fixing the position in which the cable had been laid, thereby involving extra and unnecessary expense in the connecting up of consumers; that the engineer had not exercised reasonable care in erecting a disconnecting box on the Intake Estate, and that in consequence avoidable expense had been incurred; that the voltage on the Woodhouse section was below that required by the Board of Trade, and the generating plant had been taxed beyond its capacity in an attempt to boost up the pressure; that the cost of electricity in Mansfield compared unfavourably with that obtaining in other towns of a similar size; that for excavation work for cable laying the Corporation had been paying an excessive price; that the establishment of an electricity showroom was bad policy, involving a large expenditure upon which an adequate return was unlikely; that the management of the concern needed investigation, and that the ratepayers were entitled to an explanation of how it had come about that the Corporation was ceasing to generate electricity and taking a bulk supply from the Derby and Notts Power Company.

The conclusions drawn by the Committee were, briefly, that it was satisfied that the undertaking was in a perfectly sound financial position. While it had diffidence in expressing an opinion as to the technical side of the undertaking, the Committee felt that Mansfield was to be congratulated on the fact that during the whole of the time the undertaking had been in existence there had been very few interruptions in the supply to the public. The inference, therefore, was drawn that the plant and cable was of good quality, and that the technical work in the department had been carried out satisfactorily. Further, the figures for generating costs in comparison with the published returns of other stations indicated that the Mansfield electricity works had on the generating side been economically managed. In this connection, having regard to the fact that the Corporation would soon cease to generate, and become in the main a distributing agency, the Committee felt it incumbent to take into consideration how far it might be advisable to review the staffing of the concern with the object of eliminating unnecessary expenditure. The Committee was satisfied that there was not the slightest cause to doubt the personal honour and integrity of the chairman and members of the Electricity Committee, or of the engineer and his staff. Much information had been required by the Committee, which had thrown additional work on the electrical engineer's staff, particularly the chief clerk, and it was recommended that he should be granted an honorarium of £10.

The Mayor of Mansfield, in moving the adoption of the report, said: "Our investigations have covered a period of ten years. We are satisfied, and confirmed in the view we held before the inquiry began, that there is not the slightest cause nor ground for questioning the personal honour and integrity of the present chairman, nor of any of his predecessors, nor of the members of the Electricity Committee during that or any other period, nor of the engineer or his staff. It is well to remember that all the decisions, all the acts of the Committee, are those of the Council, for the Council has confirmed the decisions and recommendations of the Committee." The motion was carried, only one member voting against it.

Accumulator Makers' Association.

The annual dinner of the Accumulator Makers' Association was held at the Savoy Hotel, London, on February 21st, when Mr. B. M. Drake presided over a large company. Our report of the speeches is unavoidably held over until next week.

The French Electrification Programme.

According to Mr. Raymond de Nys, in *Foreign Trade*, France, after the war, began the execution of a vast programme of exploitation of her immense hydraulic resources, and increased the consumption of electricity from 7,738 million kWh in 1923 to 10,000 million kWh in 1925. It was hoped that the electrification of the country districts would proceed rapidly and that several important railway systems would be able to substitute electric for steam traction. The P.L.M. completed promised work on the Culoz-Modane line, the Midi system equipped the Bordeaux-Bayonne line and introduced electric traction on its Toulouse-Pau line, and the Orléans electrified its Paris-Orléans section; but this was all, except a few short-distance lines in the suburbs of Paris.

The hydro-electric plant of Eguzon, in the Department of the Indre, was put in operation recently, and now furnishes energy to the Paris region. The new station of Mativie, on the Cère, tributary of the Dordogne, is expected to begin operations in a short time. There remains, however, in the south-east an entire network on which work has been practically stopped. In the Massif Central numerous stations were being constructed to produce 32,000 kW. On the Truyère, at Brommat, a hydro-electric plant was under construction for producing 56,000 kW. On these enterprises millions have been spent—40,000 000 fr., it is said, for the Brommat plant alone. To-day a collection of simple wooden huts with a few watchmen constitutes all that remains of the former activity. In Brittany, at Guerledan on the Blavet and at Aber-Wrac'h, two installations were being built to furnish 3,900 kW, but this work has been discontinued. All these projects have been stopped because of lack of funds. The construction of a generating station and the equipment of a waterfall involves a heavy initial capital investment. The first sites to be developed were, naturally, those which offered the greatest facilities, and the further the programme of French electrification is developed the more difficult becomes its execution. To-day's cost estimates of developing new water-power are 20 to 30 times higher than those of before the war. Accordingly, in hydro-electric enterprises long periods are required for amortisations.

Long-term money, which cost 5 per cent. before the war, now costs from 13 to 14 per cent., even with enterprises of gilt-edged credit. As the construction costs must be multiplied by 6 or 7, it is easy to see what the charges are which are now burdening the hydro-electric industry. As a result, the amount of invested capital has decreased in recent years. In spite of this, the consumption *per capita* has increased from 150 kWh in 1922 to 197 in 1923, 230 in 1924, and 250 in 1925. The consumption in Germany is said to be only 160 kWh *per capita*, in Italy 185, in Sweden 350, and in Switzerland 780. Only a decisive and rapid monetary reform, it has been asserted, as a prelude to a concrete financial programme, can restore a normal circulation of capital and ameliorate the present situation in French national finance and economics.

Service Notes.

The Air Ministry announces that increases in the Pilots' Section of the Air Force Reserve of Officers are necessary, and a large number of openings present themselves now to young men to be trained as pilots "*ab initio*." At least 50 candidates will be taken by the Air Ministry if the necessary number of the right type are forthcoming. Applicants must be of good education and physique, but need not have had any previous flying experience. They must be over 18 and under 25 years of age. Application forms and further details can be obtained from the Secretary (S.7 Reserves), Air Ministry, Adastral House, Kingsway, London, W.C.2.

Electrical Association for Women.

The first annual meeting of the Manchester District Branch of the Association was to be held on Tuesday last at the Town Hall, Manchester, and to be followed by a lecture on how the American housewife saves labour in the home, given by Mrs. Christine Frederick, of the Applecroft Experiment Station, U.S.A.

At a special meeting on February 15th, at the King's College for Women, Mrs. Frederick lectured on "How the American Housewife Solves Her Household Difficulties," and showed how important a part electricity played in the domestic field in America. She attributed the extensive use of power in the homes of that country to the attitude which the housewife took up in connection with housework. It was to her a profession; 98 per cent. of the American women did the whole of their housework.

On February 18th, Mrs. Frederick also addressed a meeting, at the Lighting Service Bureau, London, when she reviewed the past and present methods of doing housework employed by the American housewife.

Institution Notes.

Institution of Electrical Engineers.

At the ordinary meeting on Thursday, March 3rd, at 6 p.m., papers will be read on "Illuminating Engineering," by Mr. J. W. T. Walsh, M.A., M.Sc., and "The Problems of Public Lighting by Electricity," by Lieut.-Commander H. T. Harrison, R.N.V.R. This meeting will be preceded at 5.30 p.m. by a demonstration in the Common Room, by Mr. Ll. B. Atkinson, of an electro-pneumatic lamp. The lamp, in which hydrogen gas is generated, was patented in 1807, and the one to be demonstrated is believed to be the only example known. It is ignited by a spark from an electrophorus.

Institution of Chemical Engineers.

Examinations for the associate membership of this Institution will be held in June and July next. Particulars may be obtained from the hon. registrar, Mr. C. S. Garland, Abbey House, London, S.W.1.

Institution of Mechanical Engineers.

The annual report of the Council of the above Institution for the year 1926 shows a total membership at December 31st of that year of 10,117, as compared with 9,805 for the previous year. The total expenditure for the year was £33,419, leaving a balance of £443.

Institute of Metals.

The annual general meeting will be held at the Institution of Mechanical Engineers, Westminster, on Wednesday and Thursday, March 9th and 10th. On March 9th the annual dinner will be held at the Trocadero Restaurant, and will be followed by a dance. The annual autumn meeting will be held in Derby from September 6th to 9th.

The Röntgen Society.

According to the *British Medical Journal*, at a special general meeting of the Röntgen Society on January 11th it was agreed to amalgamate the society with the British Institute of Radiology. Negotiations between the two bodies had been proceeding for two years. The title of the new organisation will be "The British Institute of Radiology incorporated with the Röntgen Society." There will be no alteration in the character of the work, objects, and constitution of the society in consequence of the amalgamation.

At a further meeting of the Society on January 25th, the resolution for amalgamation was unanimously confirmed. The British Institute of Radiology will now submit a similar resolution to its members at two statutory meetings.

The Physical Society.

At the annual general meeting on February 11th, Prof. O. W. Richardson was in the chair, when the reports of the Council and of the hon. treasurer were read and adopted and officers and members of Council were elected for the year 1927-28. The president presented the Duddell Medal for 1927 to Mr. F. Twyman, F.R.S., for meritorious work on scientific instruments and materials. Messrs. Adam Hilger, Ltd., to whom Mr. Twyman has for many years been both managing and technical director, enjoys, deservedly, a reputation for the production of optical instruments employed in physical research which is not second to that of any other firm. The presidential address was delivered by Prof. O. W. Richardson, F.R.S., who took as his subject "The Present State of Atomic Physics."

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We recently reported that Dr. W. D. COOLIDGE had been awarded the Edison Medal by the American Institute of Electrical Engineers in recognition of his invention of ductile tungsten. Dr. Coolidge has now informed the Institute that he cannot accept the honour in view of the recent decision of a United States court that his ductile-tungsten patent is invalid. The decision referred to is reported in our "Notes" columns to-day.

Agricultural and General Engineers, Ltd., has appointed Sir CHARLES E. LOW, formerly secretary to the Commerce and Industry Department of the Government of India, to take charge of the Indian interests of the group.

Inspector SWINDLEHURST, of the St. Helens Tramway staff, who is retiring after 27 years' service, has been presented by his colleagues with a wallet of Treasury notes, and his wife with a lady's bag. Mr. Swindlehurst has been associated with tramway work for 47 years; he was previously at Liverpool.

Mr. J. A. FORDE, manager and engineer of the Isle of Thanet Electric Supply Co., Ltd., has been presented by the staff with a silver tea-service and tray on the completion of 25 years' service with the undertaking. The presentation was made at the employés' annual dinner by Mr. T. A. Chell, chief assistant.

Mr. HAROLD DICKINSON, city electrical engineer, Liverpool, is taking three weeks' rest in the South of France, owing to ill-health.

Mr. T. M. KIRKBY, who for many years was associated with the Metropolitan-Vickers Electrical Co., Ltd., has joined the staff of the Macintosh Cable Co., Ltd., as assistant sales manager, with headquarters at Derby.

The Edinburgh Salaries and Wages Committee, by six votes to five, recently disapproved of a recommendation from the Tramway Committee that the salary of Mr. STUART PILCHER, tramway manager, should be increased from £1,500 to £1,700 by annual increments of £100.

It is recommended that the salary of Mr. EDWIN SEDDON, electrical engineer and manager to the Edinburgh Corporation, shall be increased from £1,200 to £1,300.

General FERRIE, a leading French wireless authority, recently paid a short visit to this country. A luncheon, at which Sir John Reith, director-general of the B.B.C., presided, was given in his honour last week.

Mr. I. MACKINNON, the recently-appointed manager of the Glasgow Corporation Tramways, recommends a re-arrangement of the staff and states that the scale fixed for the chief electrical engineer, civil engineer, constructional engineer, and mechanical engineer is from £600 to £800 per annum.

The Glasgow Corporation Tramways Committee recommends the appointment of Mr. JAMES N. WILSON, now secretary and treasurer, as deputy general manager at a salary of £1,000 a year.

The Newark-on-Trent Corporation has passed a resolution thanking Mr. R. W. WILLIS for the very able manner in which he has carried out his duties, and expressing the pleasure that the Council has experienced in working with him during the installation of electricity supply in the borough.

The Portsmouth City Council has adopted the A.M.E.E. minimum salary scale as the basis of the future remuneration of its chief electrical engineer, Mr. B. HANDLEY.

The *Financial Times* states that Mr. A. SPYER has been appointed general manager of Babcock & Wilcox, Ltd., and Mr. C. S. DAVY assistant general manager.

The address of Mr. W. A. GILLOTT is now 28, Wood Street, Deansgate, Manchester.

Obituary.—DR. J. R. ERSKINE-MURRAY.—Dr. James Robert Erskine-Murray, whose death was briefly recorded in our last issue, was born at Edinburgh in 1868. He was educated at Glasgow University, where he studied under Lord Kelvin for six years. A period as a research student at Trinity College, Cambridge, followed, and later engagements included the post of Assistant Professor of Physics and Electrical Engineering at the Heriot-Watt College, Edinburgh, which he held from 1896-1898; in the latter year he became chief experimental assistant to Mr. Marconi. From 1900 to 1904 he was Lecturer in Physics and Electrical Engineering at University College, Nottingham. After this he spent two years at the George Coats Technical College at Paisley as Lecturer in Electrical Engineering, and a few years later (from 1907-1911) he lectured on Radio-telegraphy at the Northern Polytechnic Institute. He became a partner in the firm of Clark, Forde, Taylor and Erskine-Murray, the well-known telegraph consulting engineers, in 1913, but he left them in the year 1918 in connection with war activities. He did much design and experimental wireless work for the Royal Air Force between 1918 and 1922,

and in the latter year he was promoted to major. His appointment as Experimental Engineer at H.M. Signal School, R.N. Barracks, Portsmouth, followed. He held this position until his death, which occurred at Portsmouth on February 12th, after a very short illness. Dr. Erskine Murray wrote a number of books on wireless telegraph matters, and his demonstration shortly after the war, before the Institution of Electrical Engineers in London, of wireless telephonic communication with an aeroplane in flight, will be remembered by many of our readers. He was a Fellow of the Royal Society of Edinburgh, past-president of the Wireless Society of London, and a Fellow of the Institute of Radio Engineers and of the Institute of Physics. The funeral took place at Edinburgh on Friday.

SIR FREDERICK GREEN.—We regret to record the death, which occurred on Friday last, in his 82nd year, of Sir Frederick Green, a founder of the Orient Line and a director of the United River Plate Telephone Co., Ltd., and many other companies.

MR. A. BERKELEY.—Mr. A. Berkeley, wholesale electrical supplier, of 111, Granville Street, Birmingham, passed away on February 15th. The business is for the present being continued by his executors under the management of Mr. Gamble, who has been with Mr. Berkeley for many years.

MR. W. AULD.—The death occurred on February 12th of Mr. William Auld, head of the firm of William Auld & Sons, electrical engineers, of Ayr. He served on the Town Council for 10 years.

MR. J. W. COLCLOUGH.—Mr. James William Colclough, who had been employed in the electrical department of Messrs. Howard & Bullough, textile machinists, Accrington, for 30 years, passed away recently, aged 63 years.

MR. W. H. BLURTON.—The death occurred on February 9th of Mr. W. H. Blurton, who was electrician to the Highley Mining Co.

MR. G. H. ALDERTON.—Mr. George Herbert Alderton, carrying on electrical business at 31, Portland Street, Brighton, recently died at the age of 69 years.

MR. J. SMITH.—Mr. J. Smith, rolling stock superintendent in the Sheffield Tramways Department for the past 23 years, died last week, aged 66 years.

MR. H. U. WELLINGTON.—The death occurred on February 13th, at the age of 43 years, of Mr. Harry Upson Wellington, electrician at the Duke of York's School, Dover.

Will.—The late Mr. FREDERICK LEVERTON HARRIS, a director of the Metropolitan Electric Supply Co., Ltd., left £257,223 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Vacuum Power, Ltd.—Private company. Registered February 12th. Capital, £6,000 in £1 shares. Objects:—To acquire and test an invention in respect of which provisional letters patent for the United Kingdom and the Isle of Man have been granted to C. Scott-Snell and E. Scott-Snell, dated November 11th, 1926, and numbered 28,432, and to carry on the business of mechanical, electrical and experimental engineers, makers of models, &c. The first directors are:—C. Scott-Snell, 47, Linden Gardens, Bayswater, W.2; E. Scott-Snell, 47, Linden Gardens, Bayswater, W.2; J. E. Gibson, c/o Messrs. Price, Waterhouse & Co., Valparaiso, Chile; R. E. Heard, 18, Pembridge Villas, Bayswater, W.11. Qualification, 500 shares. Solicitors: H. M. Meyler & Co., 8, Churton Street, Westminster, S.W.

Mouldings and Insulators, Ltd.—Private company. Registered February 11th. Capital, £1,000 in £1 shares. Objects:—To acquire the business carried on at St. Peter's Court, Lee, S.E.12, as General Mouldings and Insulators, to adopt an agreement with H. F. Shand, J. R. F. Shand, E. A. Leyman and A. H. Norman, to carry on the business as manufacturers of moulded products and other apparatus required in connection with the distribution, supply, generation, and employment of electricity, electrical engineers, &c. The subscribers (each with one share) are:—L. S. Woolf, 37, Walbrook, E.C.4, solicitor; W. H. Burns, 19a, Coleman Street, E.C.2, chartered accountant. Solicitors: B. A. Woolf and Co., 37, Walbrook, E.C.4. Registered office: 19a, Coleman Street, E.C.2.

M. A. Halle & Co., Ltd.—Private company. Registered February 11th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers, importers, exporters, and shippers of, and dealers in electrical, magnetic and galvanic apparatus, machinery and accessories, &c. The subscribers (each with one share) are:—M. A. Halle, 26, Brunswick Square, W.C.1, merchant; J. I. Stephens, 353, Grange Road, Upper Norwood, S.E.19, merchant. Qualification, 5 shares. Solicitors: Bulcraig & Davies, Amberley House, Norfolk Street, Strand, W.C.2.

The Ship Carbon Co. of Great Britain, Ltd.—Registered as a private company on February 14th with a nominal capital of £130,000 in £1 shares (65,000 8 per cent. cumulative preference and 65,000 ordinary). Objects:—To adopt an agreement between Schiff & Co. A.G., of the first part, the Anglo-Oriental and General Investment Trust, Ltd., of the second part, and Charles H. Champion & Co., Ltd., of the third part, and to carry on the business of manufacturers of, and dealers in carbon, and all substances and materials containing or capable of producing carbon, chemists, mine owners, electrical and mechanical engineers, manufacturers of, and dealers in mechanical apparatus, lamps, batteries, dynamos, accumulators and appliances, rubber, cork, leather, vulcanite, mica, celluloid and like substances, &c. The subscribers (each with one ordinary share) are:—F. W. Eve, 101, Salisbury House, London Wall, E.C.2, cashier; L. Hillman, 101, Salisbury House, London Wall, E.C.2 clerk. Qualification, 100 ordinary shares. Solicitors: Mawbie & Barrie, 101, Salisbury House, London Wall, E.C.2. Registered office: Anglorient House, 31-33, Bishopsgate, E.C.2.

Premier Products (1927), Ltd.—Private company. Registered February 10th. Capital, £500 in £1 shares. To carry on the business of agents for mechanical, electrical, lighting, heating, hydraulic, pneumatic, ventilating, telephone, telegraph, wireless and consulting engineers, &c. The first directors are:—H. Burrows, 14, Green Street, Ardwick, Manchester, master packer and merchant; G. H. Elliott, 22, Hemingway, Blackpool, accountant. Qualification, 50 shares. Secretary: G. H. Elliott.

Southern Industries, Ltd.—Private company. Registered February 14th. Capital, £7,000 in £1 shares. To carry on the business of electrical, motor and mechanical engineers, manufacturers of and dealers in machinery of all kinds, iron founders, tool makers, brass founders, metal workers, &c. The subscribers (each with one share) are:—W. B. Enever, Broad Street House, E.C.2, articled clerk; A. Wood, Broad Street House, E.C.2, articled clerk. The first directors are W. G. Ball (chairman and life director), W. C. Taylor, F. Cressall, and I. J. Harvey. Qualification, 100 shares. Solicitors: C. R. Enever & Co., Broad Street House, Old Broad Street, E.C.2.

Amalgamated Brake and Signal Co., Ltd.—Private company. Registered February 17th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, exporters and users of and dealers in brake and signal appliances, electrical, mechanical, hydraulic and general engineers and contractors, manufacturers of and dealers in electrical, magnetic and galvanic apparatus, &c. The subscribers (each with one share) are: E. Rudland and V. Summers, 2, Bond Court, Walbrook, E.C.4, clerks. The first directors are to be appointed by the subscribers. Solicitors: Linklaters & Paines, 2, Bond Court, Walbrook, E.C.4.

Indian and Colonial Supply Association, Ltd.—Private company. Registered February 14th. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric lamps, torches, batteries, and other similar articles, optical lanterns and slides, photographic apparatus, kinematographs and films, electrical, optical, radio and scientific apparatus, mechanical, electrical and steam toys, &c. The first directors are:—J. Conoley, "Mona," The Leas, Westcliff-on-Sea, wholesale warehouseman; A. E. Cotton, 47, Swains Lane, Highgate, N.6, wholesale optician; L. Conoley, "Mona," The Leas, "Westcliff-on-Sea, traveller. Remuneration as fixed by the company. Solicitors: G. S. Warmington and Edmonds, 14-15, Coleman Street, E.C.2. Registered office: 83-86, Farringdon Street, E.C.

Century Cables, Ltd.—Public company. Registered February 17th. Nominal capital, £100,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers and traders in wires, cables and all other articles in the electrical and allied trade, and to adopt an agreement with Sir Edward Nicholl and Sir Herbert Blain for the acquisition of a freehold factory at Addlestone, Surrey. The minimum cash subscription is 7 shares. The subscribers (each with one share) are:—W. S. King, 8, Wallace Gardens, Canonbury, N.1, clerk; and six other clerks. The first directors (to number not fewer than two nor more than nine) are to be appointed by the subscribers. Qualification, 500 shares. Remuneration, £250 each per annum (chairman, £500) and 5 per cent. of the profits after 10 per cent. dividend is paid, divided between them. Secretary: G. Smith. Solicitors: Elvy, Robb & Co., 19, Bedford Row, W.C. Registered office: 137, Victoria Street, S.W.1.

Official Returns of Electrical Companies.

Anglo-Portuguese Telephone Co., Ltd.—Trust deed dated February 1st, 1927, to secure £300,000 debenture stock and premium of 2 per cent. charged on the company's rights and interests under the concession by agreements dated April 15th and June 21st, 1901, and the buildings, works, lands, and other immovable property, telephones, plant, machinery, fixtures, lines, and other chattels now or at any time to be appropriated to or used by the company in connection with the working of its system of telephones and lines under the concession and the company's other assets, present and future, including uncalled capital. Trustees: H. Allen, 31, Budge Row, E.C.; and Second Consolidated Trust, Ltd., Dashwood House, Old Broad Street, E.C.

Telephone Manufacturing Co., Ltd.—Satisfaction in full on January 5th, 1927, of land charge, mortgage and charge, and land charge, all dated August 19th, 1924, securing all moneys due or to become due from company to the Midland Bank, Ltd., respectively.

Gilfillan Brothers, Ltd.—C. E. Smedley, of Bush Lane House, Bush Lane, Cannon Street, E.C., was appointed receiver and manager on February 7th, 1927, under powers contained in debenture dated October 15th, 1926.

Joseph Tabbush & Co., Ltd.—Particulars filed of £2,500 debentures authorised January 15th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Barnes Bros. (Radiex), Ltd.—A. H. Ballard, C.A., of 6, Fen Court, E.C., was appointed receiver on February 4th, 1927, under powers contained in mortgage dated December 14th, 1926.

Siemens Bros. & Co., Ltd.—Satisfaction to the extent of £30,500 on January 1st, 1927, of debenture stock dated January 15th, 1918, securing £1,330,000.

Jones, Burton & Co., Ltd.—Satisfaction in full on January 31st, 1927, of mortgage or charge dated May 11th, 1921, securing £5,000.

Ajax Production Engineers, Ltd.—A. G. White, of 14, Old Jewry Chambers, E.C.2, ceased to act as receiver or manager on February 8th, 1927.

Claremont, Johnson & Co., Ltd.—W. J. Hodge, of 26 and 27, Union Bank Chambers, Hatton Garden, E.C.1, was appointed receiver and manager on February 9th, 1927, under powers contained in debentures dated October 22nd, 1926.

Evalasio Distributing Agency, Ltd.—Particulars filed of £1,000 debentures authorised February 8th, 1927, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £850.

City Notes.

Metropolitan Railway Co.

Lord Aberconway (chairman) presided at the annual meeting on February 17th, and in presenting the report and accounts (*vide* our last issue, p. 268), said that the general strike, with the resultant loss of traffic and extra expenses; the coal dispute, which cut down the coal traffic and involved the purchase of high-priced foreign coal; and the loss of the Exhibition traffic, represented a total loss of £300,000 to the company—equivalent to a 4 per cent. dividend on the ordinary stock. After dealing with the accounts and the developments proceeded with during the year, the chairman referred to the continued growth of competition from motor traffic. He characterised this form of traffic as a subsidised business, it being free from the burdens which the railway companies had to bear. He considered that the proportion of road construction and maintenance costs borne by motor traffic was inadequate; in effect, the railway companies, as ratepayers, were aiding their competitors. The character of the company's business was gradually changing. The long-distance traffic was increasing, but not at so fast a rate as that at which the short-distance traffic was being taken from them. The company was being assisted considerably by the operations of the Metropolitan Railway Country Estates, Ltd., which was opening up new districts. The report and accounts were adopted.

The "Underground" Group.

In our last issue we recorded the final dividend announcements of the companies forming this group. We have now received their reports for 1926 which were to be presented at the annual meetings yesterday (Thursday). These reports are summarised below:—

London Electric Railway Co.—The traffic receipts rose by £64,344 to £1,978,527, while the expenditure increased by £35,354 to £1,167,168, leaving net receipts of £811,359—an increase of £28,990. The addition of miscellaneous receipts and the balance brought forward gives an available sum of £1,103,789, as against £1,045,331. Interest, rentals, &c., absorb £504,849; £45,000 is transferred to reserve for contingencies and renewals; and after meeting preference and consolidated ordinary dividends, £100,515 is carried forward. The capital expenditure was £1,212,702, the principal item being the Charing Cross-Kennington extension (£974,622). Reference is made in this, as well as the other, reports to the adverse effects of the coal stoppage upon revenue and working expenses. The Bill promoted by the company and the Metropolitan District Railway Co. received the Royal Assent in August last. The Charing Cross-Kennington extension was opened for traffic in September, but the reconstruction of the Piccadilly Circus station was delayed by the mining dispute. The passimeter system was installed at several stations. The board has decided to renew the bodies of the company's original rolling stock. The death of Mr. Z. E. Knapp is recorded, and it is stated that Sir Ernest Clark, K.C.B., was appointed to the vacancy on the board thus created.

City and South London Railway Co.—This company's traffic receipts rose by £113,619 to £652,929, and the expenditure by £87,579 to £353,212; the net receipts thus increased from £273,677 to £299,717. The addition of miscellaneous receipts gives a total of £362,249 as net income, and to this is added £25,037 brought forward, making £387,286. After deducting interest, rentals, and other fixed charges; transferring £25,000 to reserve; and meeting the preference and consolidated ordinary dividends, there remains £29,327, which is carried forward. The expenditure on capital account was £1,015,114 (net), the largest item being £2,973,871 for the extension from Clapham Common to Morden; this extension was opened for traffic in September, and the results have exceeded expectations. The remodelling of, and the installation of escalators at, the Oval and Clapham North stations have been completed. The report mentions the death of Lord Stuart of Wortley (deputy chairman) and Mr. Z. E. Knapp.

Central London Railway Co.—The traffic receipts at £553,793 showed an increase of £42,447, and the expenditure at £365,469 a rise of £25,219. The net receipts thus rose from £171,096 to £188,324. Miscellaneous receipts amounted to £85,638, and the addition of these and the balance brought forward gives an available amount of £354,970, an increase of £9,128. Rentals, interest, and other fixed charges absorb £102,523; £40,000 is put to reserve; and after paying dividends a balance of £70,847 is carried forward. Only £47,174 was spent on capital account during the year, mainly upon the installation of escalators. Work commenced upon the improvement of the rolling stock, and steps have been taken to increase the speed of operation. The reconstruction of the Bond Street station is nearly accomplished, and escalators at this station and Tottenham Court Road are now in service. Lord Newton has been appointed to the board.

Metropolitan District Railway Co.—The traffic revenue for 1926 was £1,640,665, and the expenditure £1,122,047, showing increases of £5,887 and £19,962, respectively. The net receipts were therefore lower by £14,075, the figure being £518,618. The addition of miscellaneous receipts and the balance brought forward gives an available sum of £767,345. After meeting interest, rentals, &c., transferring £45,000 to reserve, and paying dividends, a balance of £41,501 is carried forward. The capital expenditure amounted to £93,020, plant and machinery at the Acton and Ealing Common works accounting for £62,022. Among the improvements carried out during the year were the re-arrangement of signalling on the main line and the installation of the passimeter system at several stations. The extension of the Acton works is almost com-

pleted. This will enable the company to repair and maintain the rolling stock of the associated companies as well as its own stock. Arrangements are being made for the erection of a modern office block near St. James's Park station for the accommodation of the staff of the company and its associates.

Summary of Results.—We reproduce below a comparative statement of the four companies, which, with the London General Omnibus Co., Ltd., participate in the "Common Fund":—

	1926. £	Increase+ Decrease− £
Traffic receipts	4,825,914	+226,297
Expenditure	3,007,896	+168,114
Net receipts	1,818,018	+ 58,183
Miscellaneous receipts (net) ...	537,699	+ 33,447
Net income	2,355,717	+ 91,630
Deduct Interest, rentals and other fixed charges	1,222,620	+116,399
Appropriation to reserve for contingencies and renewals ...	155,000	—
Dividends on guaranteed and preference stocks	389,477	—
Balance	588,620	− 24,769
Add balance from last year's accounts	257,673	+ 9,286
Total amount available for dividends on ordinary stocks and shares and for other purposes	846,293	− 15,483
Dividends on ordinary stocks and shares (average rate 3.54 per cent.)	604,103	—
Balance carried forward	242,190	− 15,483

Traffic Figures.—With the exception of the City and South London Railway, the traffic again decreased. The figures for the four companies were as follows:—

	1926.	Decrease.
Passengers carried—		
Ordinary	210,470,208	7,444,288
Workmen	50,580,564	836,422
Seasons	48,727,502	642,856
Total	309,778,274	8,923,566
Number of car-miles run	65,398,129	38,584

Yorkshire Electric Power Co.

The annual meeting was held at Leeds last week. Mr. A. G. Lupton (chairman), who presided, said that at great cost the company had been able to maintain the supply to its consumers throughout the period of the coal dispute. Although some of the coal imported was of a very inferior quality, much of it was excellent for steam raising. The agreements with many consumers embodied a coal clause, and if the company were to insist upon the enforcement of these the consumers would be called upon to pay considerably increased amounts, although a substantial amount would be returnable in July next if the price of coal remained normal. The company had decided, at some loss to itself, to assume a lower price for the past half year than the actual price. He felt that the consumers would appreciate this arrangement. During the year the demand for bulk supplies of electricity had increased, and the company was now supplying over 39,000 consumers directly and indirectly. The amount spent on capital account was larger than in any previous year, owing mainly to the construction of the Ferrybridge station and the laying of further 33,000-V transmission mains. The completion of the Ferrybridge station had been delayed, but on January 8th the first of the large turbo sets was put into service and was now running on load. The whole station would soon be in commission. The issue of £773,000 6 per cent. cumulative preference shares was very successful, and again added to the number of shareholders in the company, which now totalled 5,389. The company was asking for Parliamentary powers to borrow up to one-half (instead of one-third) of the issued capital. It was advantageous to raise money in this way, and he thought that the company would be able to offer a lower rate of interest than 5½ per cent. when the next issue of debentures was made. The existing debentures would have to be repaid first, however. The dividend of 8 per cent. had become a standard for the company, and it was paid after placing £60,000 to reserve and £25,000 to the plant renewal fund. The report and accounts were adopted.

Electrical Distribution of Yorkshire, Ltd.

The net profit for 1926 was £46,768, as compared with £31,099 in the preceding year. To this is added £14,114 brought forward, making £60,882. It is proposed to transfer £10,000 to reserve (making £47,000), and to pay a final dividend of 4½ per cent. on the ordinary shares (making 9 per cent. for the year), leaving £15,837 to be carried forward. The report says that there was a notable increase in the sale of electricity for street lighting and for new housing estates supplied through prepayment meters. There has been a large increase in the number of consumers in all districts, and the developments have enabled the company to reduce its charges in spite of the difficulties engendered by the coal dispute. During the year new Orders were obtained for the supply of electricity in the following districts: Baildon, Dodworth and Thurlstone, Queensbury, Ryburn Valley, South Yorkshire (extension), and Wetherby. The company now has an area of over 960 sq. miles with a population of 668,000. It is proposed to issue 300,000 ordinary shares forthwith at the price of 25s. per share, and these will be allotted to present shareholders in the proportion of three new shares to each five held. Meeting: March 1st.

Power Securities Corporation, Ltd.

In moving the adoption of the report at the annual meeting last week, Mr. G. Balfour, M.P. (chairman) referred to the death of Sir James Kemnal, an original director of the corporation and a director of Balfour, Beatty and Co., Ltd. He said that during the year the corporation had successfully handled the finance of a number of electrical and other undertakings at home and abroad, and Balfour, Beatty & Co. and the South American business were developing a number of contracts. The Lochaber water-power contracts were making progress. The Grampians development would have been commenced last year but for uncertainty regarding the effects of legislation. It is anticipated that progress will be made with the scheme during the current year. He (the chairman) had taken a somewhat prominent part in the proceedings relating to the Electricity (Supply) Act. Although he disliked the principle of the Act, they would do their best to make it a success now that it was upon the Statute Book. The company's investments were valued at £1,104,592, and 46 per cent. of this was represented by investments in electricity supply and allied undertakings. A further 2½ per cent. represented their holding in Balfour, Beatty & Co. Loans and participations totalled £139,142, as against £72,010. Approximately £64,000 was on account of the holding in the Hydro-Electric Development Co. and in two electricity supply undertakings purchased in connection with the Grampians scheme. The balance was their holding in a Spanish electrical company of which Balfour, Beatty & Co. were acting as engineers and managers. The Corporation's development might call for the issue of some of the authorised capital; at present only half of the £2,000,000 had been issued. The report and accounts were adopted.

Northampton Electric Light and Power Co., Ltd.

The report for 1926 records continued progress, in spite of the coal stoppage, the energy sold having increased from 14,278,101 to 18,471,276 kWh. In April last the capital was increased to £500,000, and the premiums received (£22,187) has been credited to the reserve. A further amount of £86,000 5 per cent. debenture stock was also issued. From the year's revenue £24,785 has been allocated to depreciation, £5,000 written off debenture discount and expenses, £4,813 transferred to reserve, and £1,000 to the employés' benefit fund. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 9 per cent. for the year, as for 1925, and £8,077 is to be carried forward. The report records the death of Mr. T. A. Dickson and the resignation of Mr. E. M. Browne, and the filling of their places on the board by Messrs. L. H. Church and F. Kilby.

Torquay Tramways Co., Ltd.

The report for 1926 records a profit of £29,241, and after providing for debenture interest and sinking fund there remains a balance of £22,641, to which is added £1,703 brought forward, making £24,344. Of this, £5,000 is transferred to reserve, income tax provision absorbs £4,200, and £111 is allowed for depreciation. It is proposed to pay a final dividend of 4 per cent. and a bonus of 1 per cent. (both free of tax) on the ordinary shares, making 9 per cent., tax free, for the year, and leaving £1,533 to be carried forward. The number of passengers carried, the car-mileage, and the revenue all showed increases, although the cost of energy was £2,000 higher on account of the coal dispute. The company's associate, the Devon General Omnibus and Touring Co., Ltd., has paid its preference dividend, and carries forward £1,802.

Mersey Railway Co.

The report for the year ended December 31st last records receipts of £217,480, and expenses of £147,536, leaving a balance of £69,944. To this are added £10,405, miscellaneous receipts, a balance of £2,325 brought forward, and £10,000 from special reserve, making £92,674. Interest, rentals, and other fixed charges absorb £65,928, £6,000 is transferred to depreciation and renewal funds, and it is proposed to pay the full dividend on the 3 per cent. perpetual preference stock, leaving £1,274 to be carried forward. The board recommends the appointment of Mr. C. A. Jones as a director. The meeting was to be held yesterday (Thursday).

Smithfield Markets Electric Supply Co., Ltd.

The net profit for the past year, after providing for debenture interest and redemption and depreciation, was £6,729. To this is added £2,394 brought forward, making £9,123. It is proposed to pay a final dividend at the rate of 5 per cent. (1s. per share), making 8 per cent. for the year. After transferring £2,000 to reserve, a balance of £2,323 is carried for-

ward. Further progress was made during the year, and the revenue was well maintained. Sir Herbert Leon, Bart., the chairman, died during the year, and his place as chairman has been taken by Sir George Leon, Bt. The vacancy on the board has been filled by the appointment of Mr. G. M. Powell, the manager and secretary, as director. Mr. A. W. Wilson has been appointed trustee for the debenture holders. The meeting was to be held on Wednesday last.

French Companies.

The *Câblerie Phocéenne*, Marseilles, has declared a dividend of 30 fr. per share for 1924-25.

The *Société des Lampes Gramme* reports net profits of 473,000 fr. for 1925-26. After placing 348,000 fr. to depreciation, the balance has been carried forward.

The *Société Centrale pour l'Industrie Electrique* reports net profits of 4,573,000 fr. for 1926; the dividend is 45 fr. per share, as against 40 fr. in 1925.

The *Compagnie Générale Parisienne de Tramways* records net profits of 3,231,000 fr. for 1926. It is proposed to maintain the dividends paid for 1925 of 16 fr. per priority share, 13.5d. fr. per ordinary share, and 3.50 fr. per deferred share.

County of London Electric Supply Co., Ltd.

The ordinary share capital as increased by the recent bonus issue is to receive a final dividend of 5 per cent.; the interim dividend on the original capital was also 5 per cent. For 1925 a total of 15 per cent. was paid.

At general meetings held on February 17th the holders of the company's first and second debenture stock approved the conversion of their holdings into Government 4 per cent. consolidated loan at the rates of £115 per cent. for the first debenture stock and £112 10s. per cent. for the second debenture stock.

German Company.

The *Electricity Company* (late *Schuckert*), Nuremberg, reports receipts from installations, undertakings and securities amounting to 4,779,000 marks, as compared with 2,844,000 marks in 1924-25. After meeting general expenses, taxes, depreciation, &c., the accounts show net profits of 3,616,000 marks, as against 1,979,000 marks in the previous year. It is proposed to increase the rate of dividend from 4 per cent. to 7 per cent.

Swedish Company.

The directors of the *Allmanna Svenska Elektriska Aktiebolaget* report that after providing for depreciation and taxes, the net profits for 1926 were 3,938,000 kr., which compares with 3,011,000 kr. in the previous year. It is proposed to pay a dividend of 5 per cent., as against 4 per cent. in 1925. The stock of orders on hand is satisfactory, and the company's position is said to be strong.

Rushden and District Electric Supply Co., Ltd.

From the revenue for 1926, £2,240 is allocated to reserve, £140 to the writing off of debenture expenses, and £500 is transferred to reserve. A final ordinary dividend of 4½ per cent. is recommended, making 8 per cent. for the year (as in 1925), leaving £1,021 to be carried forward. Mr. R. E. Lamb has been appointed to the vacancy on the board caused by the death of Mr. T. A. Dickson. The amount of energy sold rose from 1,131,691 to 1,300,823 kWh.

Wellington Electric Supply Co., Ltd.

The report for 1926 shows that after allocating £3,000 to depreciation there is a balance of £4,728. After meeting debenture charges, &c., and crediting the balance brought forward, there remains £5,396. From this £1,000 is put to reserve and a dividend of 5 per cent. is paid, leaving £2,146 to be carried forward. There was an increase in the amount of energy sold.

Marconi's Wireless Telegraph Co., Ltd.

In spite of a recommendation from its sub-committee, the Shareholders' Committee has refused to accept in advance the recommendations of the Advisory Committee (consisting of Sir Hugo Hirst, Bart., Lord Ashfield, Lord Buckland, and Mr. F. A. Szarvasy). The latter committee has therefore notified the company that it cannot accede to the company's request that it should act as an advisory committee.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

Auckland Electric Power Board.—£250,000 5 per cent. water power conversion and general extension purposes debentures.

County of London Electric Supply.—1,773,334 ordinary shares of £1 each, fully paid, Nos. 1,330,001 to 1,500,000 and 5,000,001 to 6,603,334.

South London Electric Supply Corporation.—234,000 ordinary shares of £1 each, fully paid, Nos. 310,001 to 544,000.

Companies to be Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Caergwrle and District Electricity Supply Co., Ltd.
Standard Electric Welding Co., Ltd.

Mather & Platt, Ltd.

The directors have declared a final dividend of 5 per cent. (making 10 per cent. for the year), together with a bonus of 5 per cent., both free of tax. £164,458 is carried forward. The dividend and bonus for 1925 were the same.

South London Electric Supply Corporation, Ltd.

The directors recommend a final dividend of £5 17s. 6d. per cent. on the ordinary shares; an interim distribution of 5 per cent. was made on the capital then existing. Last year's total dividend was 15 per cent., but since then the capital has been increased by a bonus share issue.

Chas. Clifford & Sons, Ltd.

Out of a reduced net profit of £10,833 (plus £41,305) brought forward it is proposed to pay a final ordinary dividend at the rate of 10 per cent. for the six months and a bonus of 5 per cent., both free of tax.

Scottish Power Co., Ltd.

The profit for the past year was £62,281 gross and £47,083 net. A dividend of 8 per cent. has been declared on the ordinary shares, £8,000 is transferred to reserve, and £2,718 carried forward.

Crossley Bros., Ltd.

The net profit for 1926 was £50,095, plus £51,221 brought forward. After paying the balance of the preference dividend £73,079 is carried forward. The ordinary shares last received a dividend in 1920 (3 per cent.).

Midland Counties Electric Supply Co., Ltd.

The directors recommend a dividend of 6 per cent. on 1,250,000 ordinary shares, and at the rate of 6 per cent. upon instalments paid on 250,000 ordinary shares.

South Metropolitan Electric Light and Power Co., Ltd.

A final dividend of 6 per cent. is recommended upon the increased ordinary capital. The interim dividend was 5 per cent. Last year's total dividend on the smaller capital was 15 per cent.

Aberdeen Suburban Tramways Co., Ltd.

There was a loss of £1,189 during the half-year ended January 31st last. This is deducted from the balance of £2,426 brought forward, leaving £1,237.

Shawinigan Water and Power Co.

A dividend of 50 cents per share has been declared on the common shares of no-par value for the quarter ending March 31st.

Clyde Valley Electrical Power Co.

It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for the year, as for 1925.

O. C. Hawkes, Ltd.

A final dividend at the rate of 14 per cent. is recommended on the ordinary shares, making 10 per cent. for the year.

Australian Company.

The Australian Wireless Co., Ltd., is increasing its capital to £200,000 by the issue of 175,000 shares of £1 each.

Bruce Peebles & Co., Ltd.

The directors recommend a dividend of 10 per cent. on the ordinary shares for the year ended December 31st last.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are less buoyant than they have been of late. The China uncertainty and a fear of money becoming dearer instead of easier; disclosure of a rather ragged speculative account in the oil market; a continuance of the new issues which follow too closely upon each other's heels—these are some of the causes that impose a check upon the exuberance hitherto shown this year. People are disposed to hold their hands. The new 4 per cent. consolidated stock, quoted at 15s. premium a month ago, is soberly priced at 3s. 9d. discount, and gives the lead to many other investment securities.

The Underground Electric Railways group is very firm, the £1 shares rising 1s. to 15s. Dividends in the combination were given here last week (ELECTRICAL REVIEW, p. 269), and it may be of use to mention the proportions in which the receipts of the pool are divided, these being at the same rates as the 1925 distributions. The District draws 12 per cent. from the pool, or "common fund," as it is called. The London General Omnibus takes 25 per cent., the London Electric Railway 41 per cent., Central London 16, and City and South London 6 per cent. By the report of the

London General Omnibus Company, it will be noticed that 1,249,000,000 passengers were carried last year, an increase of 13 millions. Total receipts came to £8,683,607; expenses took £8,323,915. Included in the latter amount is £352,000 for depreciation. The company worked at the narrow margin of 4 per cent., its ratio of expenditure to receipts being 96 per cent., a rise of nearly 1 per cent., as compared with the 1925 proportion.

Districts are 1 higher at 59, and Metropolitan consolidated shows ¼ loss on the week. A jump of 3 points in London United Tramways 4 per cent. debenture has lifted the price to 49¼. A little business developed in the preference shares, and the price strengthened to 4s. 9d. London and Suburban Traction preference remain at 6s. 6d. The ordinary shares occasionally change hands at 1s. and thereabouts.

The Electrical Distribution of Yorkshire Company, whose shares stand at 29s. 6d., will hold its meeting on March 1st, when proposals are to be submitted authorising the issue of 300,000 new ordinary at 25s. Three new shares are to be offered in respect of every 5 old shares now held. There will be, of course, a premium in the market on the new, when these are issued. The company is paying 9 per cent. for 1926. Northampton Electric repeats its previously-paid 9 per cent., the company's net profit of £44,150 being £250 up, on the year. The Smithfield Markets Electric Supply net profit is down on the year, but the dividend is maintained at 8 per cent. on the ordinary shares. The coal strike and increased taxation are given as reasons for the smaller profit.

Clyde Valley ordinary are 1s. higher at 29s. 6d. The company's final dividend of 5 per cent. makes 8 per cent. for the year, the same as before. Folkestone Electrics at 39s. 6d. show an improvement.

Westminster Electric ordinary weakened to 25s., to which price St. James' have advanced. It becomes increasingly apparent that 25s. is about the level to which London electricity supply shares will approximate with closeness until something happens to remove the list from its "groovy" character. At this price, the eventual 7 per cent. dividends likely to be paid by the companies, on their ordinary shares, will give a yield of £5 12s. on the money, although for the half-decade to the end of 1931, the returns are fairly sure to be higher. The former income is not bad for a thoroughly sound industrial investment, but, at the same time, it is not large enough to tempt new buyers unless there is a low Bank Rate ruling. Charing Cross have hardened to 25s. 6d., as the company has an extra five years tenure under its existing conditions of dividend payment. County of London shares are a trifle lower at 28s.

No change beyond a rise to 8⅞ has to be recorded in the market for cable and telephone issues. The manufacturing shares remain inanimate. Siemens shed a few pence to 29s. 6d. Telephone Manufacturing continue to be a dull market at 7s. 6d.

Marconis pursued what has now become almost a weekly habit, rising to 16s. and then reverting to 15s. Proprietors will feel disappointed at the turn which events have taken, leading to the refusal of the Advisory Committee to act. The Advisory Committee laid it down as a "cardinal principle" that any recommendation they should make would be supported by the Marconi Board and by the Shareholders' Committee. The latter has declined to accept this, and affairs are, for the time being, at a deadlock.

The issued share capital of the Marconi Company is £3,250,000 in ordinary shares of £1 each—some of which were offered to shareholders at £3 per share—and £250,000 in 7 per cent. cumulative participating preference shares. There is also outstanding an amount of £1,354,000 in 6½ per cent. convertible 10-year first debenture stock. The preference shares stand at 22s., and the debenture stock is quoted at 95 middle. In view of the unquestioned importance of the undertaking, the commanding position that it occupies in the sphere of wireless, its far-reaching ramifications, and its scope for immense extension, there is something lamentably pathetic in the present position. The sub-committee is now engaged upon a report containing recommendations designed to secure the success to which, as it maintains, the company is entitled, and which, it significantly adds, would long since have been attained with efficient administration.

Mexican affairs continue to hold out a reasonable hope of pacification in the country, and a steady return to business prosperity. On these grounds favourable attention is paid to the shares and bonds of the utility companies. Gains of 2 points have lifted Mexican Light and Power common shares to 42, and the company's first mortgage bonds to 70½. It is confidently affirmed by people in close touch with the country that the long-expected scheme is nearly ready for dealing with the question of interest arrears on the Mexican Light and Power preferred shares. Other foreign traction and lighting descriptions are quiet, Brazilian Tractions being a dollar lower, at 121. The troubles in China are not affecting this department to any marked extent, apart from the indirect influence that they exert over investment prices as a whole.

Rubber shares begin to exhibit signs of vitality, and there is a vague idea that the market may derive advantage from the check administered to the previous excitement in oil shares. The engineering group is quiet, with daily price movements narrow and irregular. In the metal market the price of copper has rallied from the price recently reached, the lowest touched for years past.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Feb. 21 1927.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14	14	60/9	—	4 12 0
Brompton Ordinary	£1	10	10	25/-	—	5 12 0
Charing Cross Ordinary	£1	15	15	25/6	+6d	5 9 10
do. do. 4½ Pref.	£1	4½	4½	17/-xd	—	5 6 0
Chelsea	£1	12	12	25/-	—	5 12 0
City of London	£1	15	15	2½	—	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Clyde Valley	£1	8	8	29/6	+1/-	5 8 4
County of London	£1	15	15	28/-	—6d	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	£1	7	8	26/8	—	6 2 0
do. 7% Pref.	£1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	£1	10	10	30/6	—	6 11 9
Kensington Ordinary	£1	15	15	24/6	—	5 14 8
Lancs. Light and Power	£1	7½	7½	24/-	—	6 2 5
London Electric	£1	10	10	24/-	—	5 17 8
do. do. 6% Pref.	£5	6	6	5⅞	—	5 10 4
Metropolitan	£1	11	11	26/-	—	5 7 8
do. 4½% Pref.	£1	4½	4½	17/-	—	5 2 10
Midland Counties	£1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	£1	7	7	21/3	—	6 11 0
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	£10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	17½	25/-	+1/-	5 12 0
South London	£1	15	15	24/6	—	6 3 0
South Metropolitan Pref.	£1	7	7	1¼	—	6 3 0
Urban Ordinary	£1	4	7	24/6	—	5 14 3
do. 6% Pref.	£1	6	6	20/6	—	5 17 1
Westminster Ordinary	£1	15	15	25/-	+6d	5 12 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	£1	8	8	29/6	+6d	5 8 4
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	5	64	—¼	4 13 9
do. District	,,	3½	3½	59½	+1	5 18 8
Underground Electric	£1	Nil	Nil	15/-	+1/-	2 0 0
do. do. Income	Bonds	6	6	104	—	*5 15 5
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	£1	3	10	2½	—	8 14 3
Chili Telephone	£5	5	6	6½	—	4 12 4
Cuba Sub. Ord.	£10	5	5	7	—	7 5 6
Eastern Extension	£10	10	10	17⅞	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 16 0
Globe Tel. and T. Ord.	£10	10	10	18⅞	—	*5 6 8
do. do. Pref.	£10	6	6	11	—	5 9 1
Great Northern Tel.	£10	20	20	26⅞	—	7 10 0
Indo-European	£5	8½	10	46½	—	*5 7 6
Marconi	£1	10	Nil	15/-	—	... ...
Marconi-Marine	£1	10	7½	1¼	—	6 13 4
Oriental Telephone Ord.	£1	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	£5	8	8	8⅜	+⅛	*4 15 7
Western Telegraph	£10	10	10	17	—	*5 17 8
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	3	—	9 13 6
do. do. 2nd Pref.	£5	6	6	3	—	10 0 0
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	,,	7	8	145½	—	5 10 0
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	£100	4	5	121	—1	4 19 4
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	+1	5 11 9
do. do. Preferred	,,	96/-	136/9	123½	—3	*4 0 0
do. do. Deferred	,,	129/5	8	160½	—2	*4 18 6
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
London & Sub. Trac. 5% Pref.	£1	2½	Nil	6/6	—	Nil
London United Tram. Deb.	Stock	4	4	49½	+4	8 1 8
Mexico Trams, 5% Bonds	—	5	5	67	—	7 8 2
Mexican Light Common	£100	Nil	Nil	42	+2	Nil
do. Pref.	£100	Nil	Nil	22½	—	Nil
do. 1st Bonds	—	5	5	70½	+2	7 1 10
Yorkshire (West Riding)	£1	5	—	10/-	+1/3	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	£1	12	12	52/6	—	4 19 1
British Aluminium Ord.	£1	5	10	46/3	—	4 6 7
British Elec. Transformer Pref.	£1	Nil	7	18/3	—	7 18 8
British Insulated Ord.	£1	15	15	70/-	—	4 5 9
Brush Ord.	£1	10	10	28/3	—	7 1 7
Callenders	£1	15	15	8½	—	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 8
Crompton Ord.	£1	Nil	Nil	10/-	—	... ...
Edison-Swan	£/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	£1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	£1	7½	7½	1¼	—	6 6 4
English Electric	£1	5	Nil	15/-	—	... ...
do. do. Pref.	£1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 8
do. Ord.	£1	5	7½	31/6	—	4 15 8
Henley	£1	15	20	4½	—	4 9 0
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	5	5	1	—	*5 0 0
Johnson & Phillips	£1	10	17½	3½	—	5 19 1
Met.-Vickers Ord.	£1	8	8	28/3	—	5 13 3
do. Pref.	£1	6	6	2½	—	6 18 4
Siemens Ord.	£1	7½	7½	29/6	—6d	5 1 8
Telegraph Construction	£2	20	16	29½	—	*4 0 8

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during January, 1927.

FOLLOWING upon last year's excellent showing, the new year opened well for the electrical export trade, auguring a period of record prosperity. It must be admitted that the increase of exports in January as compared with December was due to the rise in shipments of submarine telegraph and telephone cable, but this only accounted for about a half of the increase in the comparison with January, 1926. In placing the January list against that of the previous month, it will be seen that decreases predominated, the greatest being a fall of £51,818 in exports of telegraph and telephone instruments and apparatus, while the non-submarine cable sections showed declines. In the machinery class, however, there were satisfactory increases—£45,000 in the case of unenumerated machinery and £50,539 in railway and tramway motors. Comparing the figures with those of January last year, the increases are seen to be greater in number. Apart from the increase in submarine cables already referred to, the machinery section was responsible for the rise in the total, the aggregate increase in the three items being £139,753. The only decrease of consequence was the fall of £15,032 in the value of exported telegraph and telephone wires and cables (not submarine).

Only one of the import items was higher than in December, *viz.*, insulated wires and cables, which rose by £4,375. The result was a decrease of £62,769 in the total, over half of which was due to lower values in respect of batteries and accumulators and unenumerated electrical machinery. As compared with January, 1926, however, there was a fairly general increase in imports and, strangely enough, the principal rises occurred in the cases of unenumerated electrical machinery and batteries and accumulators. The principal decreases were in telegraph and telephone wires and cable (not submarine) and unenumerated goods and apparatus.

The comparatively unimportant re-export section dwindled still further; the increases and decreases were balanced in number, but the former were much greater in magnitude. The decrease in comparison with January, 1926, was not so great.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Jan., 1927.	Inc. or dec. as compared with Dec., 1926.	Inc. or dec. as compared with Jan., 1926.	Electrical imports for Jan., 1927.	Inc. or dec. as compared with Dec., 1926.	Inc. or dec. as compared with Jan., 1926.	Electrical re-exports for Jan., 1927.	Inc. or dec. as compared with Dec., 1926.	Inc. or dec. as compared with Jan., 1926.
Electrical goods and apparatus (unenumerated)	£187,475	— £2 555	+ £19,664	£115.242	— £7,424	— £10.132	£5 967	—£3,965	—£1,013
Insulated wires and cables ...	274.575	— 21,043	+ 6 015	60,888	+ 4,370	+ 13,195	1,707	+ 1,238	+ 1,470
Glow lamps	43,097	— 3.616	+ 716	35 931	— 5.925	— 8.675	947	— 218	— 1,314
Arc lamps and parts	1,449	+ 724	— 738	1,966	— 1,817	+ 1,636	12	+ 6	+ 10
Batteries and accumulators ...	88,381	— 16.146	+ 2,575	47.099	— 20.079	+ 22,543	360	— 2,040	— 914
Meters and instruments ...	31,709	+ 4,175	+ 9,409	22,098	— 3,840	+ 1,703	598	+ 436	— 130
Carbons	1,039	— 1,995	— 1,460	6,817	— 4,674	+ 2,549	54	+ 37	— 52
Electrical Machinery—									
Electrical machinery (unenumerated)	304,856	+ 45,300	+ 80,538	130,144	— 15,646	+ 45,946	6,589	— 1,109	+ 825
Railway and tramway motors	99,827	+ 50,539	+ 54,422	—	—	—	—	—	—
Other motors and generators ..	208,640	+ 5,791	+ 4,793	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	4,355	— 3.032	— 574	567	— 233	+ 310	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	53,558	— 20,244	— 15.032	9,727	— 2,144	— 21,937	40	+ 32	+ 23
Submarine telegraph and telephone cable...	203,486	+ 189,769	+ 189,163	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	207.811	— 51,818	— 2,559	47.621	— 5,347	— 3,232	2,480	— 4,650	— 1,958
Totals	£1,710,258	+£175.861	+£316,932	£478.100	—£62,769	+ £40,9.6	£18,751	—£10,233	—£3,053

Brazil's Electrical Imports.

Official statistics in some detail have just been issued relating to the foreign trade of Brazil in 1925. The values of Brazilian imports of electrical goods in that year, compared with 1924, are given below, together with a note of any increase or decrease. Particulars regarding the countries of origin of this material are not available:—

	1924. £	1925. £	Inc. or dec. £
Insulated electric copper wire	(thous.). 115	(thous.). 75	(thous.). — 40
Electric cables	125	125	—
Insulators	66	62	— 4
Machinery for electricity and electric light ...	865	965	+100
Electric light carbons ...	30	14	— 16
Dynamos and generators	129	197	+ 68
Electric lamps	139	187	+ 48
Motors	274	306	+ 32
Transformers	172	145	— 27

Siamese Electrical Imports.

Although the value of electrical goods and apparatus imported into Siam rose from £74,852 in 1924-25 to £76,964 in 1925-26, Great Britain's share declined from £26,000 to £22,400. This country is still, however, the largest exporter to Siam of this class of goods. In 1925-26 the values of goods supplied by our largest competitors were as follows:—Germany, £10,811; Japan, £9,556; United States, £9,411; and Belgium, £8,000 (approx.). The last country's share was almost three times as large as in the previous year. This information is contained in a recent report on Siamese conditions prepared for the Department of Overseas Trade by Mr. J. F. Johns, Consul-General at Bangkok. (Stationery Office, 1s. 6d. net.)

Polish Foreign Electrical Trade.

According to the *Board of Trade Journal*, the imports of "apparatus, conductors and other electrotechnical materials" into Poland during December last were valued at 2,712,000 gold zloty (£108,000), while the value of Poland's exports of the same class of materials was 16,000 gold zloty (£640).

The British Industries Fair.—II.

Functions and Exhibits at London and Birmingham.

THE Fair is now open, and there is great activity both in London and in Birmingham. Last Friday the preliminary Press view took place at Birmingham, and one was very favourably impressed with the extensions and improvements that have been made. Mr. T. R. Martin, the chairman of the Management Committee, in addressing representatives of the trade and newspaper Press, said that the Castle Bromwich show was the largest and most comprehensive collection of British goods ever marshalled together. He acknowledged the efforts of the Press, of the exhibitors, and of the officials who had helped to carry the Fair to a successful issue. It was a means for furthering British trading everywhere, and manufacturers could help materially by giving early notice to the organisers that they would exhibit again next year. In 1928 they would be able to bring to this country an influx of foreign buyers such as this country had never experienced if manufacturers would make known their intentions. He urged British firms to link up definitely with the Fair, forming an integral part of it by means of composite displays of particular industries. Mr. Martin said that Birmingham now possessed the finest permanent Fair buildings in the country, with unlimited scope for future extensions. If British goods were to be sold, they must be seen, and if all British manufacturers took part in the Fair, the buyers would feel compelled to come and see. The Birmingham exhibits this year number 600, as compared with approximately 400 last year. We pass on to the trade Mr. Martin's assurance that any buyer will be welcomed at Birmingham whether he has received the official invitation or not. Entrance can be obtained on presentation of his trade card or other satisfactory trade credentials.

On Monday evening, at the Mansion House, the Prince of Wales was present at a banquet given by the Government to mark the opening of the Fair. Sir Philip Cunliffe-Lister, President of the Board of Trade, presided. The large and distinguished company present included our Colonial High Commissioners, many foreign Ministers and Ambassadors, and men of eminence in various departments of trade activity at Home. The Prince delivered a lengthy, well-thought-out speech regarding British industry and trade, and some of the essentials for future success. The situation was very promising, and we were looking forward with a more cheerful spirit after all that we had passed through in 1926. He dwelt upon the qualities of enterprise and enthusiasm as the most necessary at the present time; the importance of foreign travel, collective action in industries, standardisation, better salesmanship, the freer use of foreign languages, the willingness to acknowledge that there was something new to learn every day, and other points making for efficiency. We must adopt as our policy: "Adopt, Adapt, Improve."

On Tuesday the Prince visited the Fair at Birmingham. To-day, Friday, is the first of the Electrical Days there. Others are as mentioned in the programme published here last week.

We continue below our description of the principal exhibits. In London, 900 firms are exhibiting this year, as compared with 600 a year ago. The number would have been larger but for the limited accommodation available.

The Fair remains open until March 4th.

THE BIRMINGHAM SECTION.

Macintosh Cable Co., Ltd.

The exhibit of this company includes a wide range of products, from a patent system of wiring to examples of the latest types of e.h.p. cable. An interesting feature of the display is the demonstration of various tests upon the cable-insulating and sheathing compound "Maconite." Lengths of cable thus insulated are shown immersed in various acids, alkalies, &c., with the current passing through them. The object of this feature is to demonstrate the suitability of "Maconite" cables for use under such difficult conditions as are found in chemical works, on board ship, in railway tunnels, and in collieries. Of particular interest to mining engineers are the specimens of the new Macintosh trailing cable. The salient features of the new cable are:—Each "Maconite" insulated core is separately wrapped in tinned copper strand, giving flexibility and easy access in case of damage. Being continually earthed, the wrappings prevent short circuiting of the phases; and the main earth core is completely protected from damage, being central between the phase cores. The cable is made in two forms, one for use with any type of gear and one for use with the Williams-Rowley earthing system and its gate-end switch. By means of a specimen of this type of switch (made by Switchgear & Cowans, Ltd.) the Williams-Rowley system is demonstrated. The special cable has an insulated pilot conductor carrying a low-voltage current, energised by a transformer. The circuit is made through the earth core and energises the special trip device of the gate-end switch in the event of a faulty earth. Samples of "H"-type supertension cable for working pressures of 33,000 volts and over are exhibited. (This type of cable was described in our issue of December 17th, 1926.) The essential principle is the wrapping of each of the three cores with metalised paper, which is maintained at earth potential by contact with the other cores and with the lead sheath. Tangential stresses are thus eliminated. Wired showboards display the latest developments of the Macintosh wiring system and its accessories. The system of wiring by lead-covered "Maconite" is also shown in this way. A range of boxes and accessories made for town services, &c., is included in the exhibit.

Chloride Electrical Storage Co., Ltd.

Upon this stand appears a full range of batteries suitable for every application. A selection of different types of "Chloride" batteries for house lighting is displayed, comprising both the open type and the new fully-charged, sealed-in type, which is adopted by the chief lighting-set manufacturers in this country. The batteries on exhibition include specially-designed types for radio work, including the latest developments in h.t. batteries, exemplified by the "WH type" 24-V units in multi-compartment glass boxes, and the "WJ-type" 20-V units assembled in wood crates. The usual range of batteries in celluloid boxes, together with "DTG" and "DFG" cells in glass boxes, are also on view. Higher-capacity batteries are available for inspection, and types for marine wireless installations and lifeboat sets, together with others designed for emergency lighting and gyro compass operation on board ships are represented. Other exhibits include Exide-Ironclad batteries for traction purposes; special cells for miners' handlamps and portable batteries; and specimens of the "Lux" battery, specially designed for train lighting.

Park Royal Engineering Co., Ltd.

This is a comprehensive exhibit of modern switchgear and instruments ranging from an 11,000-V heavy rupturing capacity oil switch, and a 6,000-A air circuit breaker, down to a 2½-in. ammeter. A large capacity oil switch exhibited is one of a number recently made for the Bolton Corporation. Its massive appearance, it being built up on heavy iron framing, gives no suggestion of the ease and smoothness with which it is operated. The operating handle for replacement is of the "loose handle" type and has a throw of 180 deg. in a downward direction (to close the switch) and by means of a double toggle mechanism shows the position "On" or "Off" A prominent feature of the switch is the arrangement of ample vent pipes, a necessity for switches of large breaking capacity. The gear is illustrated in fig. 7. A draw-out cubicle is exhibited. The whole of the operating mechanism can be withdrawn for attention when required, the contacts in the fixed portion being automatically covered up and rendered fool-proof. The oil switch is on similar lines to the one described above, but of proportionate size for the cubicle. Another type of oil switch of this company's design is one for wall mounting, for use in sub-stations, or for industrial purposes. It is fitted with the usual automatic features, and may be either single-, 2-, or 3-phase, for pressures up to 2,000 V. Air circuit breakers are represented by a 6,000-A, single-pole, overload type, direct operation. This, again, combines ease of operation with massive construction. An example is also shown of an electrically-operated circuit breaker where necessity or convenience requires the breaker to be re-set from a distance. Besides these types for exceptional use, examples are shown of the switchboard type of breaker, the special features of which are a definite catch so that vibration will not open the breaker, hand tripping by means of a key, and the usual qualities of ample construction and observance of B.E.S.A. standard specifications. Hand switches and self-aligning fuses are also to these specifications. The company produced instruments before it commenced making switchgear, and the latest development in this direction is the introduction of a patented method of protecting the pivots by the provision of small springs which, whilst inert in normal operation of the instrument, come into play if the instrument is subjected to shock. The adoption of this device therefore transforms what was hitherto a delicate and easily damaged instrument into a robust and serviceable unit. This device is applicable to both miniature instruments and large ones, and the company has a large range varying from a number of small models suitable for portable use, motor cars, &c., up to large illuminated dial instruments suitable for central station switchboards.

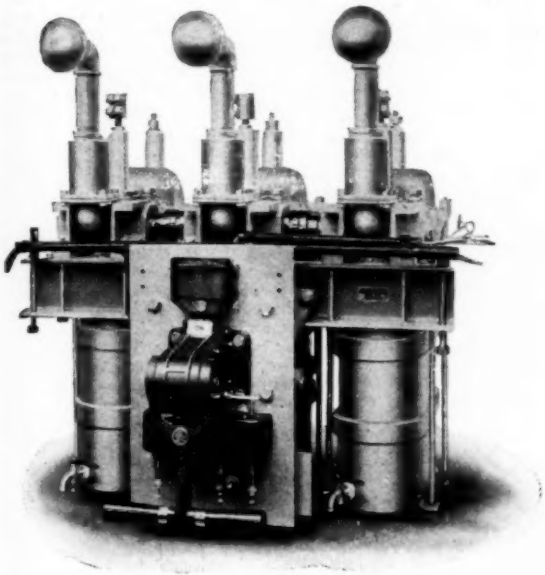


Fig. 7.—A Large Park Royal Oil Switch.

Electricars, Ltd.

The principal exhibit of this company is a 30-cwt. low-loading vehicle developed to meet the demand for one possessing a very low loading line and capable of manœuvring in narrow streets and entrances presenting difficulties to a machine of ordinary dimensions. The wheelbase is 7 ft. long, and the vehicle has a turning radius of 13 ft. Wheels of 20-in. diameter permit of a chassis height of only 27 in., so that the loading line can be anything from this figure upwards according to the type of body fitted. A single motor of very robust design drives an overhead worm axle, and a drum controller gives three speeds forward and reverse. All the control gear is mounted on the dashboard within the cab, and is thus very accessible for inspection and adjustment. A battery of 160-Ah capacity gives a road speed of 8 m.p.h. fully loaded on the level and a range of 20 to 25 miles per charge according to the class of road surface. Other exhibits include a 2-ton elevating platform truck which has been designed for use in connection with stillages whereby these are conveniently loaded as required and when ready for movement are packed up by the truck and deposited again wherever necessary. A 2-ton general purpose platform truck, which has a platform of 3 ft. 4 in. wide by 6 ft. long, but for carrying light and bulky articles it can be extended to 8 ft. 9in. by fixing the end gate in a horizontal position in the holes provided for it in the end bumper plate. The standard battery consists of 24 Edison cells of 225-Ah capacity, and this is sufficient for a full day's hard work without the need of a boosting charge. This latter can, however, be given under exceptional circumstances, thus enabling the truck to carry on for still longer periods.

George Ellison.

Conspicuous among the exhibits upon this stand are a new design of fireproof circuit breaker for use in mines, a new cable-way plug and socket connecting point for trailing cables, and an 11,000-V cubicle. The plug and socket equipment is especially designed for use in factories, mines, docks, &c., where a plug connection for portable tools and machines is a great convenience. Its cases are heavy gun-metal castings, turned, screwed and finished in steel bronze. The fixed contact case is provided with a flange for bolting to a flat surface or over the cable entrance of a totally-enclosed circuit breaker, and a screwed cap fits over the fixed contacts when the connector is not in use. A rubber packing ring firmly held on the fixed contact face makes the coupling, or the fixture covered by its cap, proof against dust or weather. A secure grip of the trailing cable is obtained by means of a screwed gun-metal conical clamp and wood bush. The terminal blocks are recessed to receive the cable strands under a clamp and are specially shaped to assist the cable grip without a strain on the binding screws. The special features claimed for it are: (1) the contacts are self-cleaning, self-aligning, spring type, offering no resistance to the effort of inserting the plug, but making forcible union between plug and socket; (2) the terminals are effective clamps for the cable strands, ensuring a good electrical and mechanical joint; (3) the trailing cable is securely gripped by a screw clamp. The plug connector box, illustrated in fig. 8, was designed for installation in an armoured cable run under a jetty, a small hole being provided for inserting the trailing cable plug. It is also suitable for use in connection with cables laid underground. The flame-proof circuit-breaker shown is designed for use in mines, and is made to withstand rough usage. It can be produced with two, three, or four poles, to carry currents up to 150 A. Four automatic releases can be fitted, including no-voltage and overload releases with or without time lag. The gear is effectively interlocked to prevent improper operation or interference. The 11,000-V cubicle shown is a steel construction, access to the gear being gained through hinged doors, which are fitted with padlocks. A unit may contain one or two sets of busbars, pole-operated isolating switches, a hand-operated oil circuit breaker, current and potential transformers, instruments, meters, signal lamps, and interlock contactors. A number of units may be erected together with continuous busbars, to form a switchboard. The breaking capacity is 150,000 kVA at 11,000 V, 3-phase, on a symmetrical short circuit. Other exhibits of this firm are sub-station switchgear, circuit breakers, "Tufnol" (a synthetic-resin insulating material), and a time-lag device for circuit breakers. The last allows the passing of the momentary rush of current upon starting.

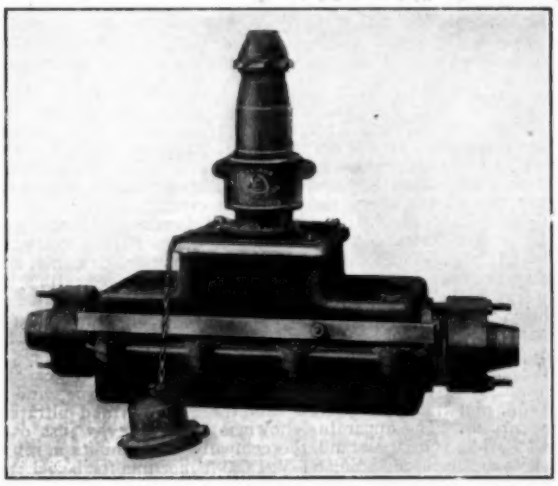


Fig. 8.—A Cable Plug and Socket Box.

W. Canning & Co., Ltd.

A working exhibit of a fully-automatic electro-plating apparatus is exhibited by this old-established company. This not only embodies practically every latest improvement in electro-plating practice, but enables work to be successfully produced without any manual labour beyond hooking the articles on at one end, and taking them off when finished at the other. As the work to be plated has to pass successively through all the preparatory cleaning and swilling vats before going into the depositing vat, and finally through swilling and dipping out apparatus after deposition, careful and accurate design has been very necessary. As will be seen from fig. 9, the various vats are placed in line, one behind the other, in their proper order. Two conveyor chains are arranged to move slowly over this line of vats, supported at intervals by idler pulleys mounted on shafts carried by steel standards on each side of the line of vats. The chains are driven at a slow speed by reduction gear from an electric motor mounted on a steel framework over the rear end of the apparatus. Steel standards are erected at intervals each side of the line of vats, each pair of which carry bearings for a shaft fitted with two chain wheels. This shaft runs just under the line of the conveyor chain and each chain wheel has a chain drive to a similar chain wheel vertically above it, which is mounted on a fixed pin carried by the steel standard. The conveyor chain track and each vertical chain is fitted with a pick-up attachment which lifts the bar out of one pair of holders on the conveyor chain and drops it into the next pair. The transporting gears are operated by a long shaft running down one side of the apparatus, which drives a worm gear on each of the steel standards connected by a chain drive to the lift gear shaft.

Although this description may seem elaborate, in reality the apparatus is exceedingly simple. The details have been carefully thought out so as to eliminate wear and breakdown. Along the length of the plating vat, just outside the track of the conveyor chain, are two angle sections of brass at such a height that the cathode suspender bars slide on them whilst they pass over the vat. These angles are connected to the plating dynamo and form the electrical connection through the suspender bar and suspending hooks to the cathode. The top of the angle bar is broken up into small inclined planes with a step down again at their finish so that the suspender bar gets a jerk every time it drops over the end of one of these planes during its travel. This forms a cathode gas-disturbing device and shakes the gas bubbles from the work being plated. The solution is heated by electrical elements, and an alternative heating system is exhibited for heating by steam coils. A combined agitating and filtration apparatus is fitted by which the solution is continually filtered free from suspended matter and kept in constant movement. The apparatus is operated by a 6-V, 250-A motor-generator for the plating vat, and a 6-V, 150-A motor-generator for the cleaning vat, which is of the electric cleaner type, and a 3-h.p. motor drives the pump for the agitation and filtration apparatus. The apparatus shown is 50 ft. long by just over 4 ft. wide. On the stand the company also exhibits a range of its dynamos, including a 6-V, 1,000-A machine for belt drive, a 2-h.p. motor polisher, and various patterns of polishing lathes for belt driving. Various types of grinding machinery, a small "Minik" plating apparatus, and various other plating accessories are shown.

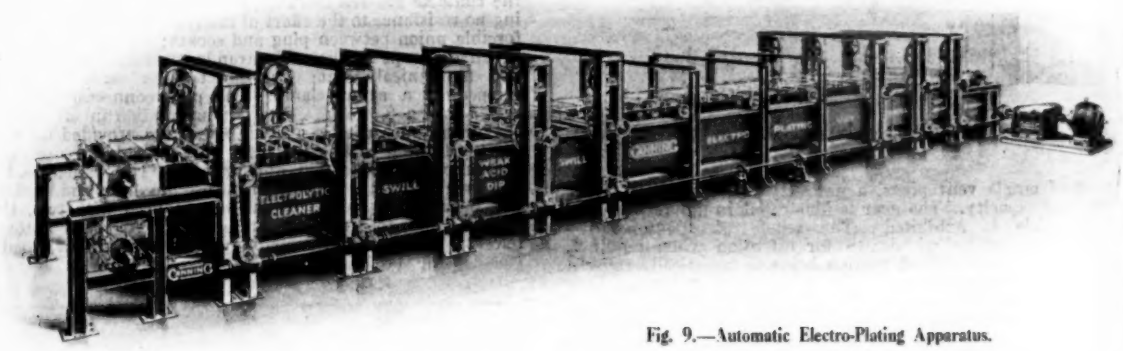


Fig. 9.—Automatic Electro-Plating Apparatus.

Electroflo Meters Co., Ltd.

The stand of this company is in the Steam Power Section, and the exhibit comprises electrically-operated fluid flow meters for the measurement of steam, water, air, oil, and gas. Two additional panels are also located in the section, one on the stand carrying the Lancashire and water-tube boilers, and the other on that carrying the turbo-generator. The first panel is the "Electroflo" standard boiler-control panel, comprising a 15-in. diameter circular dial type boiler load indicator, having 2-in. high numerals and clearly visible pointer, two draught indicators, and one pressure indicator, all circular in shape and 12 in. in diameter, so that they are clearly visible from considerable distances. The draught indicators are calibrated in 0.01 in. w.g., and have a 320 deg. scale. The importance of clear visibility of the reading instruments has been considered, and the dials are either 12 in, or 15 in. in diameter. The boiler control panel is completed with the addition of a 9-in. scale CO_2 indicator. The panel on the turbo-generator exhibit comprises two meters, one measuring the main steam supply to the turbo, and the other the condensate discharge. These meters include an indicator, a recorder, and a 5-dial continuous integrator. The panel is completed with a multi-point distance temperature indicator, complete with totally enclosed multi-point rotary switch. The exhibits on the main stand also comprise distance temperature indicators of the thermo-couple and electrical resistance type, and a multi-point continuous electric temperature recorder. The features of these instruments include straight charts, approximately 7 in. wide, and individual operating systems. The "Duplex" continuous electric temperature recorder has two entirely separate operating systems, so that any two chart records can be used simultaneously. The whole of the actuating mechanism is mounted on a bracket swinging 180 deg. out of the instrument casing. A model of the "Electroflo" meter in section demonstrating its principle of operation is exhibited.

Crossley Bros., Ltd.

This exhibit includes two "Crossley" standard types of crude oil engines representing the horizontal 4-stroke and also the vertical 2-stroke. In addition, a 1½-kW lighting set is shown; all engines can be seen in operation. The horizontal oil engine is of the cold starting type developing 32 b.h.p. as a working load, and using as fuel the cheapest grades of residual (crude) oil, in addition to standard grades of Diesel and gas oils. The fuel oil is supplied on the solid injection principle, the fuel pump being of the vertical type with double suction and delivery valves, and is operated from a cam on the sideshaft. The governor regulates the exact quantity of fuel oil admitted each power stroke by means of a control valve, and ensures that the fuel always enters the cylinder when the heat of compression is at its maximum. The Crossley vertical 2-stroke oil engine has a capacity of 14 b.h.p. working load. This engine also uses residual (crude) oil, Diesel oil, or gas oil. A special feature on the engine consists of a separate air scavenging system obtained from a low pressure air pump driven from the crankshaft. Forced lubrication is fitted throughout to all bearings and main moving parts. The Crossley lighting set consists of a 1½-kW, 50/70-V, belt-driven dynamo, coupled to a 3-b.h.p. engine, the whole being mounted on a substantial underbase. A separate wall mounted type switchboard is included. The engine is of the horizontal totally-enclosed type, with a continuous system of automatic lubrication, whereby the set will operate all day without attention, the fuel used being paraffin.

W. & T. Avery, Ltd.

This company is displaying a very comprehensive display of types of weighing machines, counting machines, testing machines, and so on. Readers will no doubt find their interest chiefly engaged here on the machines for testing specimens representative of a bulk of material and for carrying out hardness tests. Other noticeable machines will be those that count as well as weigh to a fine degree of accuracy.

Birmingham Corporation Electric Supply Department.

The principal exhibit of this department is a complete mercury-arc rectifier sub-station of 460-kW capacity, including two 138-kW booster rectifier equipments, as used in outlying areas to convert 5,000-V, 25-cycle a.c. (three-phase) to d.c. at 220 and 440 V for distribution. Another type of sub-station is an example of the equipment installed in large consumers' premises. It consists of three 100-kW transformers for reducing the pressure of the three-phase, 25-cycle supply from 5,000 to 230/415 V. In conjunction with Automatic & Electric Furnaces, Ltd., the department is showing a number of electric furnaces ranging in size from 7.2 to 21 kW, for a number of purposes and industries, including tool-hardening, carburising, annealing, enamelling, &c. Another section of the stand is devoted to welding plant, and three types are shown, *viz.*, a 3-kW butt welder, an 8-kW spot welder, and a 15-kW flash welder. In addition to these there is a large collection of all kinds of industrial appliances, including an automatic coil winder, an electromagnetic separator, a magnetic pulley, a

foundry riddle, portable electric tools, "Ozonair" air-purifying apparatus, "Morganite" factory-type heating units, &c. A wide range of domestic appliances is also shown; this includes a 4-kW coffee boiler, fires, irons, kettles, &c.

Wingrove & Rogers, Ltd.

Among the exhibits of this company is its newest product, the "Super Giant" sprung truck of the battery propelled type. This is designed to give efficient service under the roughest conditions. The drive is from the motor by means of a cardan shaft, through a worm and worm wheels, on to a differential of the fully floating type; the differential is fitted with roller bearings, all shaft ends being splined. The truck is rated at 5,000 lb., and is mounted on semi-elliptic springs, the battery being additionally sprung by means of eight helical springs suspending from the main frame. In this manner the battery is completely protected against bumps or jars. The truck is fitted with a specially designed controller, which is arranged to give three speeds in either direction and is electrically interlocked with the brakes, this rendering the truck fool-proof. Amongst the other exhibits are the "Midget Whippet" elevating truck and the company's No. 2 size locomotive. The principal feature of the elevating truck is the very handy manner in which it can be manœuvred, its turning radius being only 3 ft. to the centre of the truck, and it will turn out of a gangway 4 ft. wide into one of similar width. It is fitted with hand-operated elevating gear. The No. 2 locomotive has a hauling capacity of 10 tons. It has a cast-iron frame, the motor being situated under the driver's platform. The drive is of the spur gear type on to all four driving wheels, and efficient braking is provided upon all four wheels.

Credenda Conduits Co., Ltd.

On this stand, which is among the larger ones, is a very complete range of "Creda" electric heating and cooking apparatus produced at the company's new works at Oldbury,

Fig. 10.—A New "Creda" Cooker.

which were described in our issue of January 14th. Six different types of cookers are shown, from the "Bijou" model suitable for two people, up to a large range capable of cooking for 18 persons. The latest model is the "C.35," illustrated in fig. 10. This has a total loading of 6,300 W, made up as follows:—Oven, 1,800 W; two boiling plates (7 in. square), 1,500 W each; and grill, 1,500 W. The control apparatus is conveniently mounted at the side, and includes rotary snap switches. This cooker is designed for catering for from four to seven persons. In addition to the cookers, the company displays a large number of fires, irons, kettles, wash boilers, and other domestic appliances. One section of the stand is devoted to conduit and conduit fittings. Daily demonstrations of electric cooking are given.

W. H. Allen, Sons & Co., Ltd.

The principal item of interest upon this stand is a 250-kW geared turbo-generator set designed for back pressure. The turbine is of the impulse type, running at 6,000 r.p.m., driving a shunt-wound 110-V dynamo through double helical reduction gearing at a speed of 650 r.p.m. The set is constructed for a steam pressure of 210 lb. per sq. in., 590 deg. F. total temperature, exhausting against a back pressure of 30 lb. per sq. in. With the set are samples of turbine blading and a complete wheel. Another generating set shown comprises a two-crank compound enclosed force-lubrication engine direct coupled to a 100-kW d.c. dynamo, running at 500 r.p.m., mounted on a combined baseplate. This engine is designed for operation on a steam pressure of from 125 to 200 lb. per sq. in. exhausting against a back pressure of from 0 to 5 lb. gauge or 105-200 lb. per sq. in. dry saturated, exhausting with condenser. These two sets are suitable for works requiring steam for processes as well as electrical power. The company's oil engines are represented by a 50-b.h.p. heavy fuel oil engine designed to give its output at 375 r.p.m. It is of the vertical, two-cylinder type. A model of a 35,000-sq. ft. condenser is shown; the company has since produced condensers with a surface of 45,000 sq. ft. The pump gear exhibited includes a belt-driven "Conqueror" centrifugal pump with an output varying from 250 to 800 gal. per min. against heads of from 10 to 50 ft., the speed ranging from 640 to 1,140 r.p.m.; a model bore-hole pump; and a high-lift pump impeller and guide ring. A collection of photographs of the company's products completes the exhibit.

Rapid Magnetting Machine Co., Ltd.

This exhibit consists of electric lifting magnet equipment and magnetic separators. Three different types of the latter are shown, all of which are obtainable in different sizes. The windings in each type consist of solid metal formers insulated with fireproof material, impregnated with non-hygroscopic insulation varnish, and wound with fireprooof insulated high-conductivity copper wire or strip. These formers fit into suitable recesses in the machined castings, and in all cases renewable lifting poles having recesses for protecting the bolts are fitted. Finally, intervening spaces between the coil units and the shells are filled with insulating compound which facilitates radiation and increases the insulation resistance to earth. The mechanical construction is robust in design, and the connection boxes are fitted with spring cable protectors, the glands being watertight. Amongst the electro-magnetic separators, the "B.B." type claims attention. It consists of a framework, suspended from which is an highly-intense magnetic separator trough. A series of magnet bars stretches across the trough at right angles to the direction of flow of the material being treated; the trough, suspended on machine brackets and pins, is jig shaken by means of machined totally-enclosed dust-proof pattern ball bearing eccentrics at about 250 oscillations per minute.

Paterson Engineering Co., Ltd.

In the Model Boiler House this company shows a lime-soda water-softening plant for the treatment of boiler feed supply, having a capacity of 1,500 gal. per hour. The plant is in operation under working conditions, and is fitted with osilameter measuring and chemical supply gear, wood fibre strainers, and sludge settling arrangements. There is also displayed a model of the by-pass type osilameter measuring and chemical supply gear for the addition of lime and soda ash as installed in connection with large water-softening plants of 5,000 to 100,000 gal. per hour capacity. An interesting exhibit is the "Basex" base-exchange water softener for producing a water of zero hardness. The "Basex" softening material used in this plant possesses the characteristics of a natural base-exchange material, and is a natural earth product suitably treated to enhance its sensitivity and stability. Upon its stand next to the Boiler House the company exhibits a pressure filter as installed for the purification of sedimentary waters for boiler feed supply and manufacturing purposes. This is exactly similar to the filters used for the purification of drinking water supplies at Bradford. Another exhibit is the Paterson "Chloronome," for the continuous sterilisation of drinking water supplies.

Bulpitt & Sons, Ltd.

This company is again showing its range of electric cooking utensils. These are constructed on the immersion heater principle, which, besides giving rapid boiling, permits instant replacement. A wide range of articles is exhibited, extending to coffee percolators, kettles, egg steamers, irons, double saucepans, and steam cookers, and all the items exhibited can also be made in aluminium. A novel form of safety device is arranged to throw off the connector when overheating occurs, and this device gives a rapid break, besides furnishing visible evidence of having operated. A recent improvement is the disposal of the spare safety capsule in a recess in the handle of the kettle. On this stand is also to be seen a range of d.c. and a.c. motors, sold under the trade name of "B.K.B." Messrs. Bulpitt form part of the B.K.B. combination, and make part of the range at their Birmingham works. There is a "B.K.B." motor for driving many classes of machines, their range extending from 0.01 to 7.5 h.p. Exhibited on the stand are models of the a.c. patterns, but in addition to the ordinary 2- and 3-phase induction type, the company exhibits its repulsion induction motor and split-phase induction motor, both for single-phase. Another exhibit is a range of d.c. battery chargers, two sizes of which are intended for home use for re-charging radio and automobile accumulators.

Sturge & Baker, Ltd.

As usual, this Birmingham company shows a full range of its "Red Rose" electric fires and small heating apparatus. These are made in five sizes, and they can all be used for toasting, boiling, frying, &c., as well as for general heating. They can be wound for any of the ordinary voltages, a.c. or d.c., and the heat rays can be directed in any direction by tilting the copper reflector. Another interesting exhibit is the "Vesper" electric fire screen. This is in appearance

an attractively-designed screen for the ordinary coal fire-grate, and can be used as such during the warmer months, when a fire is not required. It contains in the centre, however, an electric fire which can be covered by a shield when not in use. It is made in various styles and sizes, including antique copper and oxydised silver finishes. Messrs. Sturge and Baker also show their spring reels and balls for coiling up slack flex and cable.

Westminster Tool and Electric Co., Ltd.

This company shows standard sizes of electric portable drills ranging in capacity from ¼-in. to 2-in. holes in mild steel, the No. 2a pattern, which is shown, representing a reduction of 22 lb. in weight as compared with ordinary drills of the same capacity, of 11 in. in overall length, and an increase of 3½ in. in length of feed. All the drills are "universal" wound, *i.e.*, they can be used on either direct- or single-phase alternating-current circuits. Two features of the small centre grinder, which are shown, are the special micrometer adjustment of the shaft and the careful balancing of the armature. The portable blowers exhibited are of value in keeping motor windings clean and for similar purposes. Several interesting examples of magnetic and other drilling stands are shown in use. Commutators of various sizes are also on view, as are samples of meter, solenoid, and switch-control coils. In conjunction with the Flexible Shaft Manufacturing Co., the Westminster Company shows long flexible shafts applied to its tools.

Electric Fires, Ltd.

Exhibited on this stand is a range of "Heatrae" electric fires, which are designed as an imitation of the old-fashioned blazing coal fire. Included in the range is the "Columbine," which is suitable for fitting in the standard coal fireplace. Samples of "Heatrae" portable electric fires are also shown, some of which embody the "Heatrae" plug-in type fire bar. These fire bars are backed by reflectors, which project the heat forward and downward as required. Practical demonstrations of the fires are given. Other "Heatrae" apparatus exhibited includes electric water heaters, low-temperature air warmers, low-temperature air tubes, water urns and glue kettles, immersion heaters, towel rails, hot plates, griller-boilers, breakfast cookers, glossing or treeing irons for the boot and shoe trade, and the "Heatrae" housewife cooker, which is designed with a view to convenience and safety for export.

Beatty Bros., Ltd.

This company exhibits its two principal products, the "Beatty" and the "White Cap" electric washers, the former being a new model. It can be worked from either a.c. or d.c. mains, the power being derived from a ¼-h.p. motor situated at the base of the machine. The agitator—the revolving wheel in the tub itself—turns 106 times a minute, and this is claimed to be faster than any other make on the market. The driving gears are mounted in a solid iron bed plate, are double cut, with wide faces, and run in oil. A wringer that can be electrically operated is attached; this can be removed when desired. The "White Cap" is built along much the same lines, except that the base and general framework are of wood instead of metal, and that the agitator is situated in the top of the tub and not the bottom.

Davidson & Co., Ltd.

In connection with the model boiler-house plant in the Steam Power Section, this company is showing one of its patent flue dust collectors, which remove from the flue gases not only the particles of grit, but dust so fine that it will pass through a 200-mesh screen. On an adjacent stand the company is showing a working model of this collector, as well as a representative selection of "Sirocco" fans, one of the fans being completely dismantled, affording the visitor an opportunity of inspecting it in detail. A small collector for dealing with industrial dust in a factory is also shown in operation. This collector is not only suitable for catching wood refuse and dust from grinders, but on account of its high collecting efficiency is also extensively employed for retrieving valuable dust produced in manufacturing processes.

Hollings & Guest, Ltd.

This company is exhibiting some of its hydraulic and other machinery, &c. Of interest is the vertical four-column press with steam-heated platen, specially designed for the manufacture of insulating materials. This is fitted with two hot plates, made of cast iron, in which the steam-heating coil is cast solid in the plate, making it practically impossible for a fracture to occur at any steam pressure. The top plate is firmly fixed to the press head, and the bottom plate is attached to the press table. The table is suitably insulated from the bottom hot plate, so as to prevent the hydraulic packing from being damaged. Other exhibits include hydraulic valves and fittings, hand-bundling presses, a light metal-bundling press, and a selection of "Ellmar" moulded pressings.

Birkbys, Ltd.

"Elo" synthetic resin products are shown by this company, comprising mouldings, moulding powders, insulating varnish and resin. "Elo" is suitable for electrical work, scientific instruments, and also for mechanical applications. It does not soften in heat, retains its shape and form under all normal conditions, is unaffected by damp, and can be moulded to very fine limits of accuracy. Metal inserts can be firmly moulded into position during manufacture if required, and within certain broad limits it can be drilled and tapped. It has a specific gravity of 1.33 to 2.0, a dielectric strength of 30,000 to 40,000 volts a.c. for ⅛ in. thickness, and a tensile strength of from 4,000 to 5,000 lb. per square inch.

Santon, Ltd.

The usual range of "Santon" electric geysers and switching plugs is shown. A three-phase geyser dealing with a loading of 12/15 kW is actually demonstrated. Another exhibit is the "Santon" heater belt. This is a flexible aluminium belt with an asbestos-lined cover, 1½ in. wide of varying lengths, which can be slipped around any existing hot-water tank and connected to the bathroom heating plug. It provides a simple means of supplying hot water, and cuts out the necessity for installing expensive storage systems. It is supplied with three loadings, viz., 500, 750, and 1,000 W.

Shropshire, &c., Power Co.

The Shropshire, Worcestershire & Staffordshire Electric Power Co. is represented by an Information Bureau which is designed upon pleasing lines. It is exhibiting a fine relief map for the area served, on which are clearly indicated main transmission and distribution lines. Another feature of interest is a collection of photographic enlargements which display to the manufacturer at a glance the advantages of the company's area in respect of transport by rail, canal, and river, and direct communication with the Bristol Channel.

Damard Lacquer Co., Ltd.

This company, which specialises in bakelite and lacquer products, is exhibiting chiefly "Formite" bakelite synthetic resin for the manufacture of insulating and other varnishes and enamels, and also mixtures for producing such articles as moulded radio components, fancy articles and the like. Other exhibits include insulating varnish, adhesive cement, ornamental "C" material, specimens of finished articles from the above materials, and specimens of metal work coated with various lacquers.

Ebonestos Insulators, Ltd.

The principal exhibit on this stand is a number of bakelite mouldings and "E.I.L." lampholders. Of interest, too, are the h. and l.p. line insulators for power transmission, telegraph and telephone lines. A noticeable feature of the stand is the erection of three sections of telegraph poles above the top of the stand, showing the actual application of "E.I.L." insulators.

W. & C. Pantin.

This exhibit is of interest chiefly to the principals of large manufacturing works and shipping houses. It consists of a vertical swing tray elevator for raising boxes, a gravity roller conveyor for carrying them, and a patent inclined belt lowering apparatus for lowering them. The vertical swing tray elevator is fitted with a patent automatic loading device for raising the boxes automatically from the gravity roller conveyor at the bottom.

Antrobus & Co.

This firm exhibits electric lighting fittings, including 3-light electroliers, pendants, bowls, wood and metal table standards, wall brackets and hall lanterns, amongst which is an entirely new design of pendant in which the band, chain and ceiling plate are made of polished Jacobean oak; a silk shade is fitted.

The "Petosign" Co.

This company is displaying an advertisement projecting machine for shop windows, showrooms, and exhibitions. This machine projects lantern slides, which change every five seconds, on to a ground glass screen embodied in the construction of the machine.

Richard Johnson, Clapham & Morris, Ltd.

In addition to various types of copper wire, this company is showing miners' safety lamps, wire lattice for road reinforcement, woven wire, wirework of various patterns, and two types of reinforcement.

J. B. Stone & Co., Ltd.

This company is exhibiting two of its "nibbling" machines for nibbling steel plate up to 5/16 in. thick. Both are entirely new and improved models, embodying many new features.

Earle, Bourne & Co., Ltd.

This company shows cold rolled brass and copper in strips and sheets, solid drawn and brazed brass and copper tubes, locomotive and condenser tubes, and a wide selection of sections and angles.

A. Morton, Ltd.

A comprehensive range of small capstan, automatic, and turned parts for the electrical and allied trades is shown by this company, which specialises in making parts to customers' requirements.

E. H. Millington & Co., Ltd.

Electrical shop signs for both inside and outside lighting are displayed on this stand.

THE LONDON SECTION.

S. G. Brown, Ltd.

There can be only one gyro compass exhibited at the Fair, because the "Brown" is the sole British representative in this specialised branch of engineering skill. Its sea performance is proved by the fact that the owners of the new *Ile de France*, 40,000 tons, the largest vessel constructed since pre-war days, have given preference to it. The workmanship throughout is of high quality. The electro-megaphone is a loud-speaker telephone for ships, railways, workshops, mines, and other places where noise is a disturbing element. The transmitted voice can be heard 100 ft. from the receiver, and the outfit is of robust and simple construction, no valves being used. To meet the needs of those who desire to purchase a broadcast radio-telephone receiver complete, the firm is showing for the first time the "Ideal" set, which includes everything that is required, together with a 21-in. loud-speaker. The set is suitable for use with an indoor aerial within a radius of six miles from a local station and 15 miles from Daventry. In addition, the new "Sphinx" loud-speaker is being placed on the market for the first time, and the company's usual range of speakers, headphones, crystal amplifiers, gramophone attachments, &c., is too well-known to require further comment.

Vulco Dry Battery Co., Ltd.

Amongst the high-voltage batteries for wireless purposes displayed are a "treble-capacity" type and also grid-bias cells. Batteries for general use are made in three grades, designed for heavy, medium, and light work; they are all made in a London factory.

Beard & Fitch, Ltd.

In this display of radio components special attention is directed to the "Success Super III" receiver, which incorporates an oxydised-silver metal panel and cabinet to match of handsome appearance. It is a 3-valve set with single-filament control and tunable between 40 and 2,500 metres, the S.L.F. condensers having a 100 to 1 ratio slow motion. Specimens of gearing are also on view.

London Radio Manufacturing Co., Ltd.

The company specialises in the design and construction of sound-reproducing instruments, and is demonstrating "Orphean" loud-speakers. Those on view include the standard model for ordinary home entertainment purposes and the De Luxe model with moulded bakelite base: both of these models are horn-type instruments. Gramophone attachments are also on view, and the "Oriel" cabinet speaker for use in the drawing or music room.

Ogilvy & Co.

The company manufactures microscopes, optical projection instruments, and medical and dental illuminating apparatus. For microscopical illumination a special "Opalite" lamp bulb of the half-watt type is available: made of a mixture of glass which presents an exceedingly fine opal surface, the filament is entirely obscured and the rays diffused, so that when the surface of the bulb is sharply focused in the plane of the object no structure or granular matter is observable in the field of view. An axial illuminator is also available.

British Electrical Sales Organisation.

"Beco" hornless loud-speakers are to be seen on this stand in various metal finishes and wood cabinets. One pattern has the unusual form of a rose bowl, and it is declared that filling the bowl with water and flowers does not impair the function of the device as a speaker.

British General Manufacturing Co., Ltd.

Broadcast radio apparatus known as "Britimax" includes 2- and 3-valve receivers built into cabinets of pleasing design, with compartments for storing batteries, and all wires are hidden from view. The sets are transformer-coupled and constructed for a wave-band of from 250 to 2,000 metres, without the need for changing coils, by the incorporation of an aerial-tuning unit, which consists of a straight-wound 10-tapped inductance with stud-switch fitted in order to select the required wave-length. The reaction coil is mounted in one end of the unit, which is designed to work in conjunction with a .0005μF condenser in parallel; to change from the local station to Daventry all one needs to do is to turn the top knob to the required stud and finally tune on the condenser.

Brilliant Sign Co., Ltd.

Illuminated signs in a great variety of styles are made by this company, electric flashing devices and time switches being a speciality; also recessed faced metal letters now so largely used for changing signs. The "Internalite" day and night sign has a design, lettering, &c., etched on polished plate glass in colour, and the illumination, provided by tubular electric lamps in the framework, is transmitted through the substance of the glass; single side signs are transparent, and do not obscure the background.

Formo Co.

This firm's wireless products are too well known to need any introduction; they are well made, the shrouded l.f. transformer being wound with 12,500 turns of wire on a Stalloy laminated core. The choke-capacity coupler has an iron core wire wound and incorporated with resistance and capacity elements, the whole being very compact. Screened coils, low-loss couplers, and heterodyne oscillators are also on view, and the straight-line frequency condenser shown has a 16 to 1 dial reduction gear enclosed in a bakelite cover which is provided with a window and fine hair line for accurate adjustment; cone bearings are used which wear concentrically, thus tending to preserve alignment.

Portable Utilities Co., Ltd.

The "Eureka" radio products shown on this stand include coils, aerial couplers, h.f. and l.f. transformers, chokes incorporating grid-leak and condenser, and ortho-cyclic condensers, each degree on the dial covering exactly 10 kilocycles, it is claimed. The large l.f. transformer is claimed to be hermetically enclosed in a coppered steel case and proof against atmospheric influence. The h.f. model is formed of two ebonite tubes, the inner one carrying the primary winding, and on the outer ribbed tube is wound the secondary coil with ample air spacing.

Electro-Magnetic Blanket Co., Ltd.

As its name implies, this company is showing electrically-heated blankets and pads for local application. The latter have a heavy copper coil at their centre, while the "Radiocoil" blanket is constructed by winding 12 strands of copper wire round a cord which is sewn in two parallel rows in two sections down the whole length of the blanket.

Artistic Shade Co.

This stand illustrates the progress that has been made during the last few years in interior lighting. The company claims to be one of the originators of the new decorative lighting movement, and is showing about 200 of its latest models. Every shade, and every part of the shade (shape, design, colour, trimming) is said to be designed by an artist, and buyers will find every type from which to choose, from the simplest to the most elaborate. Architects in particular will be interested in a series of hand-painted designs for schemes of decorative lighting carried out by this firm in various parts of the country.

Tungstone Accumulator Co., Ltd.

In addition to a full range of lighting and starting models for motor-cars, lorries, and public-service vehicles, 3 (actual) ampere-hour high-voltage wireless batteries at voltages of from 24 to 96 are exhibited. "Caxton" wireless cabinets also form part of the exhibit.

Mr. Harold Ashton.

On this stand spreaders are to be seen for constructing cage aerials. They are made of galvanised metal, circular in shape, 18 in. diameter, with nine spokes carrying nine china insulator bobbins; two spreaders are fixed on one pole any distance apart, according to the length of aerial required, and the aerial wire is wound on the insulators, between the spreaders, starting on the top spreader and finishing on the bottom spreader, the lead-in wire being taken from the last insulator on the bottom spreader. Any kind of wire may be used and any type of pole, which the spreaders are made to fit, the fixing clips in the centre of the spreader being adjustable. The Ashton aerial is also made in a portable form, similar to an umbrella when closed.

Halcyon Wireless Supply Co., Ltd.

The company specialises entirely in portable receivers, and three-, four-, and five-valve receivers are exhibited in both oak and mahogany cabinets. The five-valve receivers are guaranteed to give loud-speaker reception anywhere in England without external connections. Although a "straight" circuit, the makers are prepared to guarantee loud-speaker reception in London of the London, Daventry, Paris and Berlin stations. In addition, the Company is showing for the first time a new seven-valve portable super-heterodyne set in an exceedingly compact form, and all valves and batteries, as well as an "Amplion" loud-speaker, are enclosed in the cabinet.

R. F. Graham & Co.

The "Norbex" wireless accessories shown include crystal detectors, eight types of valve socket, plugs, &c., made of brass and nickel plated.

J. J. Eastick & Sons.

This exhibit of a large variety of radio accessories includes many patterns of plugs and sockets, connectors, adaptors, &c. Interchangeability is a standard feature, and freedom from error is guarded against by the selection of six distinct colours for the insulating sleeves of the plugs with corresponding indicating rings on the sockets.

The Stability of A.C. Systems.

Synchronous machines can be made sufficiently stable for all usual power supply purposes; the power limit and voltage regulation of transmission circuits depend principally on their series reactance.

By F. H. CLOUGH, C.B.E., M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE stability of a system may be defined as its ability to respond to the power demands for which it was designed, and it is very closely associated with voltage regulation. When power is transmitted over long distances, stability needs very careful investigation. Although transmission and distribution circuits in this country are usually sufficiently stable, being comparatively short, we are probably nearer to the instability point on large synchronous machines than is generally realised. To show more clearly what is meant, assume that a sub-station or distribution point is fed over a line containing considerable reactance; the power factor of the load at the sub-station is assumed to be 0.8, and the reactance in the feeder 100 per cent., *i.e.*, the reactance is equal to the impedance of the load under full-load conditions. In order to give normal voltage at the sub-station at full load, the voltage at the supply point must be 79 per cent. higher than at the sub-station: if the voltage at the supply point remains constant at 179, and if the load is varied in magnitude, but always with a power factor of 0.8, then the sub-station voltage will vary according to the curve ABC (fig. 1), where the voltage is given in relation to the current flowing. By plotting the product of current and voltage corresponding to it, a power curve DBC is obtained which attains maximum value at normal full-load conditions. The power factor at the sending end would be 0.446, and a machine of 179 kVA would be required to give 100 kVA at the sub-station. On the assumption of normal voltage at the sub-station at full load, the voltage at the sending end will depend on the power factor of the load; for unity power factor 141 volts would be necessary, and for 0.8 leading power factor 89 volts. In all cases, however, the maximum power limit would have the same value, and would occur at full load; fig. 2 gives the curves for unity, and fig. 3 for 0.8 leading p.f. If the load at the sub-station consists of induction motors, such a system would be unstable—for if the motors are called upon to supply additional load, they will respond by taking more current, so that the voltage will rapidly fall off and the motors will come to a standstill. If synchronous motors were installed, the system would be equally unstable if the power factor remained at the original value, but synchronous motors can be made to supply leading current to change the power factor, and the power limit can be raised. Instability does not necessarily occur at the point of maximum power; generally, the natural limit for power stability of a circuit is reached when the external reactance is about 100 per cent.; or, in the case of a transmission line, maximum power will be transmitted when the impedance of the load is approximately equal to the reactance of the line.

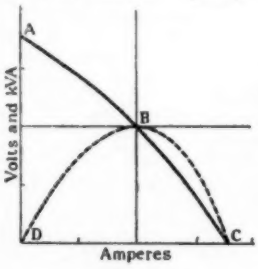


Fig. 1.

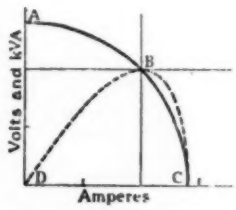


Fig. 2.

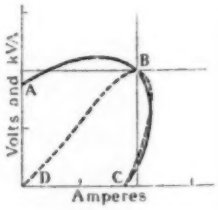


Fig. 3.

When the reactance of a line is high, a large amount of reactive kVA is required to send the current over it: if this is supplied by the generators at the sending end these machines will be unduly large and will operate at low power factor, and the voltage at the sending end will be very high. It is preferable to subdivide the total reactive kVA, placing some at the receiving end in the form of synchronous condensers, as by so doing the power factor of the line can be raised, the voltage at the sending end reduced, and the voltage at the receiving end held approximately constant. The stability of the machines can be used also to raise the stability of the system. In certain cases synchronous condensers are connected to intermediate points along the line; this makes a long line equivalent to several short ones in series. The presence of considerable capacity currents in high-voltage lines helps to improve the power factor and reduce the amount of reactive kVA supplied by the synchronous machines.

In the present state of the art, where large powers have to be transmitted over long distances, it would seem desirable to split up the line into a series of shorter lines, or else to generate and transmit at low frequency and convert to normal frequency by means of motor-generators at the receiving end. With low frequency the reactance could be made low enough to give the necessary stability, and as the voltage could be varied for varying loads the maximum use could be made of the capacity current to give unity power factor and reduce the size of the synchronous machines.

Artificial stability is not necessarily inferior to natural stability—the terms are only used in a distinguishing sense. Cases of instability, where alternators are supplying an induction-motor load, have occurred, and sometimes such cases are rather difficult to understand, because the motors will trip off the circuit due to the voltage falling, and, as soon as they have tripped off, the voltage will again be restored. In an alternator the excitation corresponds to the voltage at the source of supply, and the synchronous reactance to the reactance of a feeder. This "feeder" is highly inductive, but both ends are near together, so that a regulator can be connected to the receiving end (the machine terminals) to control the voltages at the source of supply (the exciter). By this means artificial stability can be obtained. In fig. 4 the curves of an alternator controlled by a regulator are also shown.

If a machine operating at normal voltage is suddenly short-circuited, the current momentarily rises to a value several times normal, and at the same time the exciting current rises to a high value by induction. An explanation would be that there is a hypothetical internal voltage in the machine, which is proportional to the increased excitation, and that the current is equal to this voltage divided by the total synchronous impedance of the machine. This increase in excitation occurs partly in the exciting winding and partly as currents in the heavy damping windings and solid metal parts of the rotor. This phenomenon means that such a machine has two limits of stability, one for gradually applied loads which gives a low value of stability, and the other, a much higher limit, which occurs when the load is suddenly applied, for instance, when the machine is short-circuited. Under actual service conditions the stability will fall somewhere between these two limits.

The turbo-alternator should have two automatic governors, one operated by change of speed to control the power of the turbine, and the other operated by change in voltage to control the excitation of the alternator: the former controls the energy component of the current, and the latter the inductive component; both should operate so that the alternator is able to deliver both load and wattless currents up to any demands within the limit of the capacity of the machine. The mechanical rotating parts of a turbo-alternator set have a considerable amount of momentum, or stored energy, usually amounting to about 6 or 10 kW-seconds per kW of rating of the set. This corresponds to a mechanical time-constant of about 3 to 5 seconds, which means that during any period when the load is changing, mechanical energy may be borrowed from the rotating masses to make up any excess or deficit in the supply of steam energy, and as the time-constant is reasonably long there is considerable time available for the governor to act and the steam supply to be adjusted to the new conditions. In an alternator similar conditions exist, as there is in the rotor a considerable amount of magnetic energy which will supply excitation whilst the voltage regulator is adjusting

the exciter to the new conditions of load. The stored magnetic energy has a value of about 4 or 5 kW-seconds per kW of exciter rating, or time-constant of 2 to 2½ seconds.

During normal operation the armature reaction of the stator tends to suppress the flux, and the exciting current tends to maintain it. If there is a sudden increase in the load, additional currents are induced in the exciting windings and also in the damping windings of the rotor: they flow in opposition to the stator currents and tend to oppose any change of flux during the changing period. The increase in magnetic energy associated with any increase in rotor current is taken from the mechanical energy of the rotating masses.

The rate at which the flux ultimately changes depends on the losses caused by currents flowing in the rotor copper. Due to the large amount of copper in the rotor, these losses are low, and current can be sustained for an appreciable period by the magnetic energy of the rotor. The magnetism of the field acts as a link in the conversion from mechanical to electrical energy, and the stored magnetic energy acts as a reservoir for maintaining excitation during changes of load.

The design of regulator and exciter should be such that the excitation can be corrected to the new value required during the time available: usually most suitable is the vibrating type, which intermittently short-circuits a portion of the field rheostat of the exciter, so that it responds very quickly to changes of voltage. The exciter must also be made to respond quickly to the control of the regulator; this means that the field spools must be made with low time-constants, and that it is preferable to use a separate source of power for exciting the field spools of the exciter, preferably a small auxiliary machine with a highly saturated magnetic circuit incorporated in the same frame with the main exciter.

The use of a separate source of supply for the exciter fields is highly desirable for another reason, as by this means instability of the exciter is avoided. In large machines main field rheostats are undesirable for several reasons, and therefore the exciter must work over a wide range of voltage. If made self-exciting, its voltage is liable to be indefinite, and the exciter to become unstable at low voltages; this difficulty is removed by using a separate source of excitation.

Suitably designed alternators can be made sufficiently stable, so that they can be regarded as fixed points when considering the primary voltage distribution of a system. The capability of transmission lines and feeders of supplying power to, and maintaining voltage at, distant points of a system has also been touched on. The transformer sub-stations fed from the primary system can be considered as fixed voltage points for the voltage distribution of the lower-power, lower-voltage secondary feeders; and similarly for the tertiary and quaternary systems if used. In the primary system the generator reactance limits the maximum fault current, and in the subsidiary system the reactance of the step-down transformers fulfils a similar duty. Any additional reactance in the feeders reduces their value as conveyors of power and should be kept as low as possible.

The maximum fault current in a circuit should have some reasonable relation to the normal current carried. This means that a small feeder should not be connected to a high-power bus-bar, and a main trunk feeder should not be tapped to give a small power supply. The main primary trunk feeders should be used only to convey large blocks of power, and, in order to give maximum reliability and reduce the cost of high-power switchgear, they should be few in number and have a minimum number of tappings. Present practice indicates a limit for the fault current in any part of a large system to that corresponding to about 500,000 kVA. In a large system it may not be possible to get down to this value without using so much reactance that the voltage regulation is too poor, or the system tends to become unstable. In such cases the system should be split into groups which, however, will be connected together by means of the lines containing considerable reactance.

A tie line between power stations is usually put in with a definite intention of supplying power in one direction. If the reactive kVA of the line and load is supplied by the generators at the sending end, then their voltage must be raised to deal with the line drop. If, however, synchronous condensers are installed at the receiving end of sufficient capacity to supply the reactive kVA of the load and part of the line, there will be very little line drop. In the latter case voltage control at the receiving end can be effected by adjusting the capacity current of the synchronous condensers, provided that the voltage at the sending end is kept high enough to give stability.

In certain cases it may be necessary to transfer power in either direction over a tie line. If there is sufficient reactive capacity at both ends, then the direction and amount of the energy flow can be controlled by adjusting the governors of the prime movers, and the proper voltage can be controlled by adjusting the excitation of the synchronous machines. In practice there will usually be more synchronous machinery available at one end than at the other, and consequently it may be necessary to use taps on the transformers to get the right adjustment of power flow and voltage. It will probably be a convenience if tap-changing can be done under load.

To illustrate these conditions, assume a 75-mile, 50,000-kVA, 132,000-volt line: at 50 cycles the line reactance would be about 30 per cent. If no synchronous condensers were used the generators at the sending end would have to be rated at approximately 60,000 kVA at 0.67 power factor, and the voltage-drop over the line and transformers would be about 25 per cent. If synchronous condensers were installed, their rating would be about 40,000 kVA, but the generators would be only about 40,000 kVA and could operate at approximately unity power factor. The synchronous-condenser arrangement is more costly than the other, as a total plant capacity of 80,000 kVA in two machines is needed, instead of 60,000 kVA in one: there is, however, a saving in the size of transformers.

The power limit of the line will depend primarily upon the total reactance, which should preferably not exceed about 50 per cent.; but actually rather more stable conditions will exist if synchronous condensers are installed. Voltage control at the supply point by means of synchronous condensers is more conveniently and satisfactorily carried out than by changing the voltage at the sending end, or altering transformer taps, which would be necessary if no synchronous condensers were installed. Synchronous condensers can provide reactive kVA where it is wanted near the load, and consequently lagging currents need not be transmitted over inductive lines, and the voltage regulation of the system is better. When power is supplied over an inductive line there is a considerable phase angle between the voltage vectors at the two ends. Synchronous machines carrying load have also an internal phase displacement between their mechanical and voltage vectors. If machines at both ends of a line are operating as generators, the difference in their mechanical displacement will be approximately equal to the phase difference due to the load on the line. If the machine at the receiving end is a synchronous condenser, the mechanical displacement will be that of the generator and line, whereas if the receiving end machine is running as a motor, the total displacement will be due to the generator, line, and motor. If there is a change in load of either machines or line the displacements will change also; when the load changes suddenly, mechanical and electrical oscillations may occur.

When a synchronous machine is oscillating, the power flow and torque may be assumed to be proportional to the amplitude of swing, as shown by the line BAC in fig. 5. For large angles there will be a tendency for the power to droop, as shown by the line BA_1C_1, but, depending on the frequency of oscillation and the time-constant of the rotor, supplementary exciting currents will be induced which will prevent this droop. A damping winding on the rotor will produce a torque displacement curve BDCEB, and the oscillations will be quickly quenched. If two, or a group, of machines forming two systems are coupled by means of a small tie line, the torque will fall off for larger amplitudes of displacement, on account of the limited power that can flow over the line, and the relationship will be as shown by curve FAG. Such a tie line would be too small to hold the systems in synchronism when a bad load fluctuation occurred, although it might be sufficient to hold them in synchronism during normal steady service. A larger tie line would hold the systems in synchronism, but would allow too much current to pass if a fault occurred. A solution might be to connect portions only of the two systems together. In some cases where it is not economically feasible to build a sufficiently large tie line, the systems may be allowed to break apart (each carrying its own load) at a suitable point where the least disturbance to the power supply will occur.

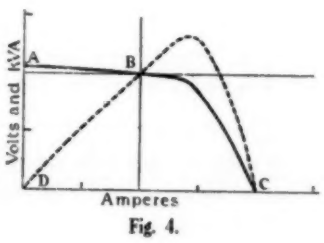


Fig. 4.

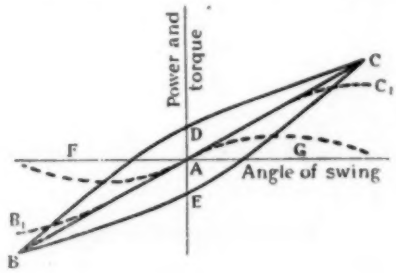


Fig. 5.

Discussion in London.

Mr. C. H. MERZ opened the discussion by remarking that the paper was particularly opportune, as the legislature now seemed to have reached a state of stability. He hoped the system which would result from recent legislation would not be so complicated as some people seemed to think it would, although the paper was not very hopeful in that direction. Future development would result in an entirely new picture, and the author had directed attention to matters which would have to be guarded against. Fortunately, in general, the difficulties were got over as the system grew, although others might then be introduced by short-circuit currents, so that

a careful balance between the various factors was needed. Not only had the designed power to be considered, but also that which the system would have to carry momentarily under fault conditions, the latter not being so easy to provide for without running risks in other directions. Separate excitation of the main machines would not fit in with the policy (which was the right one) of subdividing generating units in a station. Regarding the author's reference to the cost of high-power switchgear, in this country it would invariably be necessary to lead the power out of a generating station at two, at least, or more voltages: therefore, the practice of connecting the transformers directly to the generators would lead to undesirable double transformation in series. It was that aspect which had led the Americans to do their switching at the generator voltage, in spite of the difficulties introduced thereby. He hoped that the design of synchronous condensers would be given immediate consideration, not left till such apparatus was called for; abroad the use of such plant had resulted in considerable savings being made. One of the most valuable features of the paper was that it urged engineers to look ahead.

Mr. A. R. EVEREST agreed that the paper was timely, for the new conditions that would arise in the near future would raise to prominence features which had not been conspicuous in the past, and might involve the adoption of measures that had not been considered necessary hitherto. It had apparently been realised some years ago that the time constant of generators could not be lengthened much beyond the present figure, and so the subject resolved itself into the use of automatic regulators.

Mr. W. E. HIGHFIELD thought that, good as the paper was, the author had chosen a somewhat confusing method of presenting his arguments. The problem centred round the employment of very long e.h.p. lines, and, when suggesting methods of compensation, the author must have held his breath a long time before advocating a reduction of frequency. The lower frequencies should be avoided, and although they were adopting the idea in Canada, they did not contemplate frequency-changing. High-voltage lines that supplied cotton mills had given trouble recently, and it was very difficult to explain to the millowner the reasons therefor; he gauged continuity of supply by his old steam reciprocating plant, which very seldom broke down, and electrical engineers must live up to the same standard. It was of interest to note that the lines concerned had been rectified, not by compensation, but by placing them underground in single-core cables.

Major A. M. TAYLOR pointed out that trouble was not confined to long lines, short ones being also involved if the power carried were large enough. The author looked at the subject from the alternator designer's point of view; his diagrams were not good, they did not show what was taking place from moment to moment, and were not a patch on the circle diagram, to explain which the speaker used several lantern slides. In America they had had considerable experience of the difficulties outlined in the paper, and it was significant that there the use of synchronous condensers was favoured in preference to regulation from the alternator end of the line.

Generating at a lower frequency and raising the frequency at the receiving end of the line in order to reduce the reactance of the line, when it was a long one, met with the speaker's approval; in fact, he had publicly suggested it, but it was not the only way, and it was not realised that raising the voltage was the best way to cure the reactance trouble; he believed very firmly that instead of the old rule of 1,000 volts per mile the voltage of even short transmission lines, if the power were considerable, could with advantage be doubled or even trebled: doubling the voltage reduced the reactance effect four-fold, and also greatly reduced the cost per kW transmitted by an overhead line.

Mr. H. W. TAYLOR outlined the advantages of separately exciting the main generator's exciter. The characteristic of an alternator controlled by a regulator as shown in fig. 4 was desirable, but only attainable if the exciter responded very quickly: it would do so if its time constant was low, and therefore when separately excited. The small exciter must not be considered as a fractional horse-power machine; it must be designed for much more than it would be called upon to perform, and in the case of the plant with the design of which he was associated the small machine was made in the same shop and under similar conditions as the large one.

Mr. A. WRIGHT endorsed what had been said about the circle diagram, and explained that the American 220,000-volt lines had been perfectly stable up to 250 miles in length, and would carry much more power than the normal in case of emergency. When the length was increased to 400 miles, however, very different conditions obtained.

Mr. F. H. CLOUGH, in reply, explained that he did not advocate two frequency conversions: in the case of water wheels low-speed generators were usual, and a low frequency would therefore be convenient and involve conversion at the receiving end only. With synchronous condensers located along a very long line he could visualise the current distribution being somewhat like a corkscrew: the machines at either end would be mechanically displaced by perhaps half a revolution; it was owing to the phase difference between the voltage vectors at the two ends of an inductive line that he suggested frequency changing. The 400-mile American line mentioned failed because the phase angle was so large, whereas in the case of a 250-mile line the voltage had been chosen so high as to keep the reactance of the line low, and it was therefore stable. Synchronous condensers were preferable from the operating point of view, and their use would not be more expensive than providing all the reactive kVA in the main generators.

South African Railway Electrification.

Some instructive operating data relative to the 175 route miles of converted main line in Natal between Glencoe and Pietermaritzburg.

ONE of the most important developments in railway operation in South Africa took place during June, 1926, at which date the work of converting 175 route miles of the Natal main line from steam to electric traction had reached the stage of permitting the introduction of a full electric service between Glencoe and Pietermaritzburg. In that connection the following extracts from the report of the general manager of the State Railways and Harbours Board for the year ended March 31st, 1926, are of considerable interest. He refers, of course, to the 95 electric locomotives supplied by the Metropolitan-Vickers Electrical Co., Ltd., for operation on the line in question:—

"It is as yet too early to give the actual economic advantages, expressed in money, of electric traction, as compared with steam, or to comment thereon extensively, but it is possible to give actual results in respect of some of the features of the two methods of transportation during the period the scheme has been in process of completion. The electric locomotive has been quick to demonstrate its superiority in two directions, particularly higher speeds on grades and increased availability for traffic purposes. Whereas the electric locomotives are, under normal conditions, available during approximately 90 per cent. of the twenty-four hours, the steam locomotives on the same section were ordinarily available for not more than 50 per cent. of the time. The greater continuous capacity of the electric locomotive has enabled heavier individual trains to be handled at higher speeds than was practicable with the steam locomotive. An analysis of the operating speeds on the electrified section shows, for example, that one of the passenger trains which formerly required 8 hours 17 minutes for the 175-mile run, is now handled in 7 hours 47 minutes, an acceleration in schedule speed of 30 minutes. In the reverse direction an acceleration of 37 minutes has been obtained.

"A typical goods train schedule shows a decrease of 6 hours and 15 minutes under electric traction. The schedule for a steam locomotive to haul the heaviest trains between Glencoe and Pietermaritzburg was 16 hours 30 minutes with the following loads:—

From Glencoe to Ladysmith	1,000 tons.
From Ladysmith to Mooi River	820 tons.
From Mooi River to Pietermaritzburg ...	850 tons.

"Three electric units manipulated by one driver and an assistant now convey 1,500 tons throughout the distance in 10 hours 15 minutes. The load for the journey in the reverse direction (from Pietermaritzburg to Glencoe) with one steam locomotive was 385 tons, the schedule time allowance being 14 hours; with three electric units 800 tons are hauled to a schedule time allowance of 10 hours. These accelerations have had the effect of considerably speeding up the transit of traffic on the Natal main line. The average transit for coal trains between Glencoe and Booth Junction under steam conditions was 34 hours 15 minutes; the journey is now performed in approximately 25 hours 9 minutes. In the reverse direction the transit time for 'empties' to the collieries has been reduced by 9 hours 26 minutes.

"Under steam conditions the factors which contributed principally to the lengthier transit were: low speeds up gradients; remarshalling of trains at Ladysmith, Mooi River, and Pietermaritzburg owing to the varying load restrictions over the different sections, and time occupied at frequent intervals for watering locomotives and attending thereto on the journey. A 1,500-ton train is conveyed the entire route between Glencoe and Pietermaritzburg by electric traction without being disturbed; the average speed up the gradient between Estcourt and Mooi River, where there is a ruling grade of 1 in 65, is 21 miles per hour, compared with eight miles per hour under steam; the electric locomotives require little or no attention en route.

"The electric units are averaging 7,000 miles per month, as against the steam locomotive's 2,700, and some of the units have already done 75,000 miles without heavy overhaul. Steam locomotives had frequently to be withdrawn from service for heavy repairs after having accomplished from 25,000 to 30,000 miles, although there are instances of such locomotives having given better performances. The heaviest tonnage moved south of Ladysmith under steam on any one day was 25,351 tons, and this was not accomplished without a considerable strain on the resources; in fact, the movement of such tonnage under steam conditions could not be maintained daily for any length of time.

"During the financial year ended March 31st, 1926, when a partial electric service was in operation, the average daily tonnage moved south of Ladysmith was 19,343, and the highest tonnage moved south on any one day totalled 27,466. The most recent records disclose that during July, 1926, when a full electric service was in operation, traffic (including passenger traffic) moved south of Ladysmith averaged 25,438 tons daily; the highest tonnage on any one day during the same period aggregated 27,104. The capacity of the line under electrification has up to now been governed by the number of electric locomotives available: from the experience gained to date, there is no reason why, with additional equipment, the existing line should not handle up to 40,000 tons a day, or more.

"Each electric unit has a one-hour rating of 20,000 lb. The largest steam locomotive displaced exerted a tractive effort, at 75 per cent. boiler pressure, of 48,375 lb., as compared with the 60,000 lb. of three electric units; the increased effort of the latter is steady in character, which makes it the more effective. It has been argued that a modern steam locomotive will haul 1,500 tons, whereas three electric units are required to haul an equivalent tonnage: this is correct, but, in the case of the steam locomotive, an important factor to be considered when making comparisons is the grade over which loads are hauled. It is true that a steam locomotive of the articulated type conveyed a load of over 1,500 tons between Pietermaritzburg and Cato Ridge, but this was on a grade of 1 in 100, and over a section where the electric units do not work. Three electric units are hauling 1,500 tons between Estcourt and Mooi River over a grade of 1 in 65; one particular steam locomotive conveyed 1,011 tons over the same section, but the electric units haul 1,500 tons in 68 minutes less time than it took the steam locomotive with 1,011 tons. For a steam engine to haul 1,500 tons up a grade of 1 in 65, it would require to be, approximately, of 75,000 lb. tractive effort, and even then the speed would probably be limited to 10 miles per hour, whereas three electric units convey 1,500 tons with ease at speeds averaging from 20 to 23 miles an hour.

"The steam locomotives used on the section now electrified were the most powerful on these railways. For handling the normal traffic before electrification, 130 steam locomotives were required. The motive power equipment for electric operation, which, incidentally, is being called upon to handle a greater tonnage than steam, includes seventy-eight 3,000-volt direct-current units designed for both passenger and goods work."

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

A Memorial to Faraday.

Will you kindly permit me to invite the interest of your readers in the following:—

The progress of electrical science and industry in the past century is founded largely upon the results of the labours of the illustrious natural philosopher, Michael Faraday, whose experimental researches and discoveries opened wider the power-houses of nature and pointed the way to the utilisation of the forces stored therein, as evidenced by the present universal application of them, particularly electricity, in the service of mankind, and who, in the words of Sir Oliver Lodge, initiated a whole new profession—Electrical Engineering—while Sir Richard Gregory, in a recent presidential address, declared that "every dynamo in the world owes its origin to Faraday." In his lifetime he was described as "our great electrician."

Michael Faraday, to whom the world thus owes so large a debt of gratitude, was born in Southwark, the son of a blacksmith, whose forge stood near the well-known local landmark, the "Elephant and Castle."

To commemorate this great pioneer worker, who in the world of science holds a place almost equivalent to that of Shakespeare in the world of literature, the Southwark Borough Council desires to form a special collection of standard and current literature on electrical and allied sciences in the Central Reference Library of the borough, which is situated close to the spot where the forge stood.

It is suggested that the memorial shall include also a bust of Faraday.

The use of the library is not limited to local residents, but, like the benefits of Faraday's discoveries, is open to all. Moreover, it is centrally and conveniently situated near the junction of all the main thoroughfares of populous South London converging upon the principal London bridges; and it is well used—there was an issue of over 100,000 volumes last year.

It is purposed to create a Faraday Memorial Library Fund, the income from which would be expended in the acquisition of the best new books year by year, and so keep the memorial collection always abreast of developments in, and practical applications of, the sciences for which Faraday did so much.

The Council would welcome the co-operation of electricians and scientists generally, many of whom, it is believed, would be glad to know of this opportunity to assist, if only in a small measure, in establishing in Faraday's native borough a memorial that will be worthy, permanent, and increasingly useful in character.

The year 1927 has been described as the "Dawn of Britain's Electrical Age," and the time would thus seem appropriate to pay tribute to the memory of the man who made the "Electrical Age" possible.

The project has the interest and generous support of, among others, the Royal Society, the Royal Institution, Messrs. Benn Brothers, the British Electrical and Allied Manufacturers' Association, the Eastern Telegraph Co., the Western Union Telegraph Co., the British Thomson-Houston Co., the General Electric Co., Provincial Tramways Co., Ltd., Messrs. J. Dewrance & Co., Ltd., the County of London Electric Supply Co., the City of London Electric Light Co., the Edison Swan Electric Co., Messrs. W. H. Willcox & Co., and a number of private individuals.

I shall be happy to acknowledge any contributions which may be sent to the Town Hall, Walworth Road, S.E.17.

H. Hewitts,
Mayor.

Southwark, *February 15th*, 1927.

The Earthing of Portable Domestic Appliances.

I wish to support the views of Mr. R. H. Rawll, as expressed in his article on the earthing of portable domestic appliances. In my house I have provided all-electric equipment, including water heating, although one coal fire is in fairly constant use in the kitchen. All the plugs are three-pin, and each earth-pin socket is connected to earth *via* the lead covering of the wires and the water pipe. All the appliances, with the exception of table lamps and the vacuum cleaner (this was supplied with a long piece of 2-core flex which I have not yet changed to 3-core), are earthed. With the exception of two Berry fires and a wash boiler, no provision was made on any of the apparatus for earthing. The earthing of stationary apparatus presents no difficulty, but portable apparatus, such as saucepans with plug and socket connections, and perhaps three heat control by a combination of three pins and three sockets, present difficulties when earthing is desired. Manufacturers only supply these with earthing connections if specially ordered. I have never tried specially ordering, as I should probably have to wait about eight weeks and pay extra. My method is to attach an earth connection myself, and here another difficulty arises. The insulation of the slip-on sockets is so weak mechanically that it is difficult to work, and if it be broken I invariably find that the replacement (worth 4d. at the most), must be specially ordered. I don't know whether the B.E.S.A. specification calls for earthing these appliances, but as there is nothing to prevent their use near a water tap the I.E.E. wiring rules do call for earthing.

Some supply authorities are deserving of blame in connection with this matter. There are one or two with very stringent regulations of their own who have showrooms containing all kinds of gadgets without any provision for earthing. They also put their service cables and meters over concrete floors, and do not earth them or box them so that there is no risk of anyone touching them.

There have been many fatal shocks from hand lamps—hence the regulations. Must history repeat itself, or shall we be wise in time?

A.M.I.E.E.

[The fatalities in connection with hand lamps have not occurred in private houses.—EDS. ELEC. REV.]

The article by Mr. R. H. Rawll under the above heading in your issue of February 11th raises several points of considerable interest and importance.

Personally, I am inclined to agree with Mr. Rawll in principle, but the solution is not as simple as he would have us believe.

Assuming that one agrees that all appliances should be earthed because they may be used in rooms where earthing is regarded as essential, it necessarily follows that manufacturers must discontinue their present practice of supplying small domestic appliances, such as kettles, irons, &c., taking, say, 500 watts or less, with adaptors and twin flex.

To guard against the danger which Mr. Rawll suggests, they should be fitted always with 3-core flex and a 3-pin plug.

Admittedly the cost of a 3-pin earthing plug and socket is not very serious, but although it acts as a safeguard against accidental contact with "live" apparatus it does not entirely meet cases such as occur in sculleries, bathrooms, &c., where the switch also is a potential source of danger. Here either the switch should be entirely insulated or the dolly earthed. The ideal arrangement is a 15-ampere combined interlocking 3-pin earthing switch-plug. I have for a long time been trying to find such an article which, while being capable of breaking 3 kW at 230 volts, is sold at a reasonable price and is not such an ugly and clumsy-looking piece of apparatus as to be vetoed for use in a lady's drawing-room.

All switches on heating circuits must be capable of breaking the circuit of a 3-kW fire "full on," as people are not always careful to operate the switches on the fire first.

The potential market for such an article is so great that the manufacturers would be well advised to get busy on the problem—by no means an easy one.

Incidentally, if it is to be generally accepted that all portable apparatus must be earthed, since their use may not be restricted to rooms where they may be deemed safe, even 5-ampere plugs should be 3-pin and all flex connected to such appliances 3-core.

By the way, does Mr. Rawll propose to wire all plug points, when C.T.S. is used, with 3-core cable?

So much for this side of the picture. The other side is this: Are we not making too much fuss about the whole business?

How many fatal accidents from unearthed apparatus have been recorded in, say, the last ten years?

Which is likely to have the greater deterrent effect on the more general use of electrical apparatus, an ever-increasing cost of installation, or the remote risk of a fatality, or of some such unpleasant experience as an individual who shaves in the bathroom and gets more than he has asked for from his sponge?

I express no opinion, but invite your readers to give theirs.

The Midland Electric Power Installation Co.
H. JOSEPH, *Proprietor.*

Wolverhampton, *February 15th*, 1927.

[The opinion which we hold, and have repeatedly expressed, is that endeavours to secure 100 per cent. safety are misguided, and doomed to failure. An installation may be wired and equipped in faultless style, complying with the most stringent "rules," but how long will it remain perfect? When flexibles are renewed, as they must be, what likelihood is there that three-core flexibles will be used? What assurance is there that the earthing connections, leads, or bonds will never be severed—without the slightest indication of the fact? Above all, what need is there for absolute safety, when no such burden is imposed upon gas, oil lamps, candles, matches, coal and coke fires, windows, staircases, and other potential sources of danger in private houses? Statistics should govern the question; there have been probably more deaths through noxious gases entering houses from short-circuits on electric mains in the street than from electric shocks received inside private houses in this country. Only in such places as bathrooms are special precautions essential.

The imposition of irksome and superfluous restrictions and regulations on the public is a characteristic national fetish.—EDS. ELEC. REV.]

Electricity Supply Tariffs.

In his comments upon my recent articles, Mr. Lunn quotes the Darlington tariffs against those of Basle, and concludes that my figures are not representative. Let me assure Mr. Lunn that a glance at the published data of the electrical undertakings in the U.K. will be sufficient to convince him that the figures which are not representative are those of Darlington. And this is true even when they are compared with the tariffs of much larger stations. In this comparison I need not take advantage of the high figures of 1926 which were affected by the recent coal strike. I will confine myself to 1925. Then, as against £3 and 0.25d. for power in Darlington, I find that the price in Liverpool was £6 and 0.4d. Or, on comparing towns more like Darlington and Basle in size—for we must pay attention to the size and character of the undertaking—let me ask Mr. Lunn if he can point to any town of 70,000 inhabitants in which the prices are as low as his?

Again, as regards cooking and heating, the Darlington figure is almost unique. A comparison of all the undertakings of reasonable size in the U.K. shows that the average price per kelvin for this purpose is about 1.5d., as against 0.75d. in Darlington.

How Mr. Lunn has achieved the figure of 0.56d. as the cost per unit sold on a load factor of 26.36 per cent. I cannot explain, but he asks a very pertinent question in connection therewith. "Why," he asks, "should electricity not be supplied in most towns in this country at prices lower than those in Switzerland?" Ah! Why, indeed! That, also, I cannot explain!

But, relatively to my main contention, these are side issues. It has been stated before the I.E.E. that the second 25 per cent. of load factor can be delivered at a quarter the price of the first. If, therefore, Mr. Lunn could increase his l.f. from 26.36 per cent. to the Basle figure of 74 per cent., he could reduce his prices much further and establish a record. Now the domestic load is usually considered to be the worst for this purpose, and yet it is by encouraging this very load in the proper manner that 74 per cent. has been achieved. And the chief instruments have been tariffs B (8) and (9), the deferred payment agreement A (2), and simple but reliable time switches. Mr. Lunn's seasonal system is undoubtedly a step in the right direction, but it will only improve the seasonal load factor. It is the diurnal load factor that needs attention.

There is much force in Mr. Legge's contention as to cooking during peak hours. But it is also true that in many small Swiss households the chief meal is taken at mid-day, and much can be done by the intelligent use of long-hour electric apparatus embodying the "hay-box" principle.

Mr. Thwaites points out that in certain English towns the prices for large amounts of power are lower than in Basle. So they ought to be. But is it quite fair to compare great industrial centres of half-a-million inhabitants with Basle and its population of 145,000?

The University, Birmingham. **William Cramp.**
February 20th, 1927.

A Knotty Problem.

Referring to "A Knotty Problem" in the "Correspondence" columns of your issue of the 18th inst., it is difficult to advise on this matter without adding to the perplexities of "Perplexed."

The principal claims of the screwed-conduit system to superiority over other systems are complete protection of the conductors from mechanical injury, and immunity from fire. These claims can, however, only be substantiated if the system is complete with ironclad switches and fuseboards, and totally enclosed lighting units. These conditions are costly, the whole installation is somewhat inflexible, and does not lend itself well to extensions and alterations, and, in my opinion, is not suitable or necessary for the premises and requirements under consideration.

Grip conduit will give the required degree of protection, and is easier to install; the ordinary standard type of fittings can be employed, and it is consequently cheaper than the screwed job.

Other systems of wiring mentioned, *viz.*, metal-sheathed, C.T.S., and Maconite, are approved by the Institution of Electrical Engineers, and may be adopted with confidence, provided that the I.E.E. "Regulations for the Electrical Equipment of Buildings" are observed.

The majority of installation contractors specialise each in one particular system of wiring, and carry a stock of the particular material required; therefore it is only natural to assume that they will specify, and boost, that system.

A more important point than the choice of system is the question of workmanship, and my advice to "Perplexed" is to put the matter in the hands of a reliable and reputable contractor, and to cease from troubling himself.

Epsom, *February 19th*, 1927. **H. H. Atkinson.**

Kiosk-Type Sub-stations.

Is it not high time that manufacturers of kiosk-type substations realised that it is even more important in an outdoor kiosk than in an indoor cubicle to protect live conductors against accidental contact?

It is common practice in cubicle work to provide separate doors for the isolating switch and oil switch compartments, yet in the kiosk described in your issue of February 11th (page 231), which purports to represent the latest practice, a single door is provided, and the writer claims that "the design has been considerably simplified" by providing only one interlocked door.

This interlocking, however, does not prevent the switch attendant from coming into accidental contact with the live isolating switch blades when he is inspecting the oil-switch contacts, &c., the risk of which is far greater when one is slipping about on wet grass in inclement weather and with imperfect lighting.

An interior door to the isolating-switch compartment, even if it were only expanded metal, would guard against this danger.

P. M. W.

Waltham Cross, *February 18th*, 1927.

The Salaries of Engineers.

There exist, to my knowledge, two organisations whose functions are partly to safeguard the status of the technically-trained electrical engineer. I refer to the Chartered Institution of Electrical Engineers, and to the National Union of Scientific Workers. The former exists only in the interests of electrical engineers; the latter exists, professedly, in the interests of all technically trained men, including electrical engineers. These bodies are unlike, in that the former is well known, whilst the latter is but little known, in spite of its 8½ years of existence. They are alike, however, in their

persistent neglect to tackle the most urgent problem of the electrical engineer—that of starvation salaries. Since they refuse to perform this portion of their functions, it becomes necessary for the private individual to do what he can to forward the interests of the technical man. Hence this letter.

I see that a world-famous firm with London offices advertised a post in your last issue. The *essential* requirements (my italics) are: "(1) A thorough knowledge of the French language. (2) A sound general education and technical training. (3) Practical training and experience in the manufacture, erection, and running of heavy electrical plant; (4) Commercial experience in the preparation of tenders and correspondence. (5) Outside commercial experience."

The munificent salary offered for this highly trained man is £350 per annum. The probability is that some poor blighter, in desperate straits, will sell his services for this salary. Comment is unnecessary, but I cry shame on any employer who so disgraces himself, and on the bodies who profess to safeguard our interests, and fail to make the slightest attempt to do so.

February 18th, 1927. **Another Poor Blighter.**

Extra-High-Pressure Transmission.

The letter by Mr. W. Fennell in your issue of February 11th raises the important question: Which is the more reliable, an overhead line or an underground supply? He then proceeds to take up the case for the overhead, at the same time giving the impression that the author of the article in question takes the opposite view.

Mr. Fennell shows the important distinction between the frequency of failure and the length of stoppage, and reasonably associates the former with overhead lines, and the latter with cables. His humorous reference to sending a window-cleaning gang out on an overhead line may be more to the point than is intended, for, much as the wise and bold policy of replacing insulators in a bad position has to recommend it, this policy will, in many cases, only postpone the date at which the porcelain cleaning gang will be necessary.

To have to clean insulators is not unusual even in power stations. Outside, the rain will not always do this duty, especially under the sheds of the insulators. Fortunately, cleaning is not often required, but where pin insulators are used in bad situations for voltages of 33,000 V and above, it is certainly most desirable yet difficult to carry it out.

A further difficulty not altogether solved is the quick location of a faulty insulator; and where overhead lines are very long and take short cuts over difficult country, patrol is not easy, and repairs may take a considerable time to effect.

There are certain inherent weaknesses in overhead lines which cannot be overlooked, especially where large bulk supplies are concerned, and where real continuity is essential. For such continuity a duplicate supply is necessary, and not merely an alternative supply as suggested.

Overhead lines have to work under adverse conditions such as are outlined in an article in your issue of December 3rd last. It is hoped that by pointing out and promoting discussion on the weaknesses of overhead lines, the necessity for really sound and reliable cables for super-pressures will be made more generally evident, for both overhead lines and cables for these pressures are necessary, and the development of the former has not kept pace with the latter.

With regard to Mr. Fennell's reference to G.P.O. trunk lines, he has apparently been unwittingly assisting in providing revenue for the financing of extensive underground developments for some years, and the responsible authorities would no doubt inform him of their activities if requested.

London, *February 15th*, 1927. **A. T. Scott.**

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

18,950. "Method and arrangement for directional transmission and reception by means of electric waves." W. Hannemann. August 4th, 1924. (237,906.)

19,368. "High-speed vertical-shaft electric motors." Soie de Chatillon Soc. Anon. Italiana and M. Biroli. July 30th, 1925. (264,617.)

19,473. "Panel mountings for electrical apparatus." A. H. Grebe. December 5th, 1924. (244,046.)

21,189. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 24th, 1925. (264,680.)

23,723. "Means for regulating the terminal voltage of a generator." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 22nd, 1925. (264,891.)

26,132. "Inductance coils for use in radio apparatus." Igranic Electric Co., Ltd., P. W. Willans, and L. E. Curran. October 19th, 1925. (Cognate application 2,186/26.) (264,897.)

26,326. "Mounting electric inductance coils." C. F. Halsall. October 21st, 1925. (264,901.)

26,336. "Telephone systems." Standard Telephones and Cables, Ltd., and A. H. Cameron. October 21st, 1925. (264,902.)

26,395. "High-frequency alternator." F. Newton. October 21st, 1925. (264,903.)

26,477. "Telephone systems." Standard Telephones and Cables, Ltd., A. J. Chanter, G. C. Hartley, and W. R. Moscrip. October 22nd, 1925. (264,905.)

26,487. "Electric transmitters for use in automatic telegraphy." Creed and Co., Ltd., F. G. Creed, and R. D. Salmon. October 22nd, 1925. (264,906.)

26,488. "Telegraphic transmitting and tape-perforating apparatus." Creed and Co., Ltd., F. G. Creed, and R. D. Salmon. October 22nd, 1925. (264,907.)

26,592. "Wireless direction-finding apparatus." G. Du Bourg de Bozas. April 3rd, 1925. (Addition to 235,898.) (250,170.)

26,595. "Thermionic valve amplifying arrangements." M. Graham, A. Graham (legal representative of E. A. Graham, deceased), and L. H. Paddle. October 23rd, 1925. (264,910.)

26,671. "Apparatus for filtering and rectifying electric currents." Dubilier Condenser Co. (1925), Ltd. October 24th, 1924. (241,946.)

26,777. "Control of dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. C. Liddiard. October 26th, 1925. (264,912.)

26,779. "Electric lamp holder and connections therefor." British Thomson-Houston Co., Ltd., and H. C. Wheat. October 26th, 1925. (264,913.)

27,005. "Electric furnaces." Siemens-Schuckertwerke Ges. December 15th, 1924. (244,426.)

27,027. "Electrical connections." R. S. Macrae. October 28th, 1925. (264,924.)

27,031. "Detachable adjusting handles or levers for variable electric condensers and other apparatus." J. J. Rowe. October 28th, 1925. (264,925.)

27,047. "Telegraphy and telephony of the kind employing high-frequency oscillations." A. C. L. Turpain and Soc. des Etablissements Gaumont. October 28th, 1925. (Addition to 241,237.) (264,926.)

27,077. "Telephone systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). October 28th, 1925. (264,927.)

27,078. "Signal-transmission systems, and more particularly picture-transmission systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). October 28th, 1925. (264,928.)

27,197. "Prepayment arrangements for automatic telephone systems." Siemens Bros. & Co., Ltd., and A. E. Caswell. October 29th, 1925. (264,932.)

27,286. "Wireless transmitters." J. K. Im Thurn, G. Shearing, and C. Matthews. October 30th, 1925. (264,935.)

27,415. "Protective devices particularly for use in telephone systems." Standard Telephones and Cables, Ltd., B. B. Grace, and H. J. Gowring. October 31st, 1925. (264,941.)

27,986. "Electrical time-lag devices." British Thomson-Houston Co., Ltd. (General Electric Co.). November 6th, 1925. (264,949.)

28,316. "Devices for interrupting an electric current." W. J. Tennant (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 10th, 1925. (264,954.)

28,675. "Mechanical rectifiers for alternating current." Siemens-Schuckertwerke Ges. December 12th, 1924. (244,438.)

28,967. "Electric motor convertor sub-stations." T. W. Ross, C. Ryder, and Metropolitan-Vickers Electrical Co., Ltd. November 17th, 1925. (264,961.)

29,826. "Electric storage batteries or accumulators." Edison Swan Electric Co., Ltd., and G. E. Webster. November 25th, 1925. (264,970.)

30,495. "Process and apparatus for therapeutic treatment." T. R. N. Gerdes. December 2nd, 1925. (264,976.)

30,890. "Insulated supports for electric cables and the like." Siemens-Schuckertwerke Ges. December 10th, 1924. (244,457.)

30,963. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. C. Puckette. December 8th, 1925. (264,979.)

31,739. "Electric switches." Brookhirst Switchgear, Ltd., and J. A. Hirst. December 16th, 1925. (264,986.)

1926.

168. "Electric stoves." J. E. Raworth (McClary Manufacturing Co., Inc.). January 4th, 1926. (264,991.)

449. "Multiple-filament electric incandescent lamps, vacuum tubes, and the like." C. Cristesco. January 6th, 1926. (Convention date not granted.) (245,777.)

1,425. "Electric storage batteries or electric accumulators." Fuller's United Electric Works, Ltd., and S. C. Whaite. January 18th, 1926. (265,000.)

3,555. "Automatic electric switching systems." British Thomson-Houston Co., Ltd. February 6th, 1925. (247,222.)

3,958. "Installations for repeating indications of movement at a distance." Evershed & Vignoles, Ltd., and C. Midworth. February 11th, 1926. (265,012.)

5,237. "Wireless receiving apparatus." C. H. C. Cansdale. February 24th, 1926. (265,017.)

5,941. "Tuned amplifying circuits for wireless receiving apparatus and the like." Lovejoy Development Corporation. June 4th, 1925. (253,072.)

8,749. "Automatic quick-acting circuit-breaking device." P. J. Branchu. April 8th, 1925. (250,570.)

9,355. "Electric illuminated advertising device." H. K. T. Lindquist and C. V. Madsen. April 9th, 1926. (265,038.)

9,442. "Uniformly-loaded signalling conductors for the transmission of currents of acoustic frequencies." Felten & Guilleaume Carlswerke Akt. Ges. June 8th, 1925. (253,078.)

9,615. "Electric traction system for agricultural implements." F. Remy. April 12th, 1926. (265,040.)

10,070. "Systems for converting electric currents." British Thomson-Houston Co., Ltd. April 18th, 1925. (250,966.)

12,140. "High-frequency electric signalling systems." British Thomson-Houston Co., Ltd. May 11th, 1925. (252,027.)

12,286. "Method and apparatus for removing hydrogen from the surface of metal objects to be coated by electrolysis." L. J. J. Van der Hoorn. May 12th, 1926. (265,047.)

12,821. "Variable electric condensers." International General Electric Co., Inc. May 22nd, 1925. (252,376.)

16,081. "Sound recording or reproducing devices." Standard Telephones and Cables, Ltd. May 29th, 1925. (Divided application on 23,665/25.) (254,333.)

16,083. "Horns for acoustical instruments." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). September 22nd, 1925. (Divided application on 23,664/25.) (265,060.)

17,556. "Hollow electric cables." Siemens-Schuckertwerke Ges. April 29th, 1926. (Addition to 254,308.) (265,066.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 16th:—

Tropex. No. 476,330. Class 4. Raw or partly-prepared vegetable, animal and mineral substances used in manufactures.—Chloride Electrical Storage Co., Ltd.

Mecvent. No. 476,789. Class 6. Electrical fans and blowers.—P. M. Millns, trading as the Millns Electrical Co., 17, Whitefriars Street, E.C.4.

E.S. (lettering and design). No. 474,990. Class 8. Electrical measuring instruments, switchboards, cables, current limiters, accumulators, radio-telephonic receiving apparatus, and parts therefor.—Edison Swan Electric Co., Ltd.

Nora. No. 476,192. Class 8. Apparatus for radio-telephony.—Aronwerke Elektricitats Gesellschaft, Charlottenburg. (British representative: Henry Fairbrother, 30-32, Ludgate Hill, E.C.4.)

Hegra (lettering and design). No. 476,581. Class 9. Apparatus for use in radio-telegraphy and telephony.—B. Becker, trading as Georgs Becker, 203-205, Edgware Road, W.2.

Allhall. No. 476,591. Class 8. Loud speakers.—L. Kremner, 49a, Shudehill, Manchester.

Junoscale. No. 476,903. Class 8. Electrical measuring instruments.—Johnson & Phillips, Ltd.

Asbestulon. No. 476,275. Class 50. Insulating substances (electrical).—Thomas de la Rue & Co., Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AIREDALE (Yorks).—Kinema, for A. Whitaker, The Square.

ALTRINCHAM.—Extensions, County Girls' School; Cheshire Education Committee.

AYRSHIRE.—Central fire station at Kilmarnock; burgh surveyor, Kilmarnock. Alterations to Alloway Public Hall (heating installation by radiators); Sir Robert Lorimer, architect.

BAWTRY.—Housing scheme (80), for Doncaster R.D.C.; Walker & Thompson, architects, Carbon Chambers, 7, Hall Gate, Doncaster.

BECKENHAM.—Roman Catholic church; J. B. L. Tolhurst, architect.

BEDFORDSHIRE.—Ouse improvement scheme (legislation necessary) (£2,750,000); Board of Agriculture.

BIRKENHEAD.—Kinema, Borough Road; H. A. Thomas, Liverpool.

BOSTON.—Additional 70 houses, for the R.D.C.; surveyor.

BOURNEMOUTH.—Additions, Donegal Works, Hamkinson Road; H. C. Skerratt, Ltd. Pavilion, Woodland Avenue, for Corporation; J. Scott.

BURFORD (Oxon).—Cotswold Gateway Hotel (with electrical work and heating), for H. G. Powell, Kidlington; J. R. Wilkins, architect, Oxford.

BURTON-ON-TRENT.—Additional 300 houses, for the T.C.; borough surveyor.

CANTERBURY.—Re-erection of premises, High Street, for H. J. Goulden, Ltd. (several thousand pounds).

CARDIFF.—Conversion of Green Dragon premises for tram dept. offices; city architect.

CHATHAM.—Hospital extensions (£39,000), for Medway B.G.; C. W. W. Thompson, architect, Rochester; F. E. Wallis, builder, Maidstone.

CONGLETON.—Housing scheme (108), for the T.C.; borough surveyor.

CROYDON.—Super kinema, Main Road; Pavilions, Ltd., 505, Oxford Street, London, W. Hotel, Aerodrome (£50,000), for Barclay, Perkins & Co., Ltd.; E. P. Pullan, secretary.

DONCASTER.—Reinstatement, after fire (several thousands pounds damage) of clothing store and casual ward at Doncaster Workhouse; clerk, Board of Guardians.

DUMFRIES.—Extensions, with electrical work (£2,450), for the Dumfries-shire Unionist Association, Loreburn Street; secretary.

EARLESTOWN (Lancs.).—Additional 152 houses, for the U.D.C.; surveyor.

EDINBURGH.—Working men's hostel; city architect.

FIFESHIRE.—Golf cleek factory at Anstruther; c/o burgh surveyor.

GLASGOW.—Public hall in East End; city engineer. 306 houses and 10 shops at Ruchill, for Corporation; city architect. Extensions, including Central Hall (£35,000) for School of Art; John Keppie & Henderson, architects. Improvements, Queen's Theatre, Watson Street; B. Fruitin.

GUILDFORD.—Flats (60), Aldershot Road, for the T.C.; J. W. Hipwood, borough engineer, Tuns Gate.

HALESOWEN.—Electric light installation, Congregational Hall; H. Jones, secretary, 53, Stourbridge Road. Super-kinema (£12,000), for S. Bray; T. Stanley Beach, architect; Messrs. Tate, builders, Cradley.

HEADINGTON.—Housing scheme (436); W. Page Webb, architect, 23, High Street, New Headington, Oxford.

HEREFORD.—Tile factory, Barr's Court; city surveyor.

HEYWOOD.—Housing scheme (100), for T.C.; G. A. Russell and Sons, builders.

HUDDERSFIELD.—Extensions to Greenhead High School and Almondbury Grammar School, for the Borough E.C.; borough architect. Hospital block at Crosland Moor Institution; clerk to Board of Guardians.

KIRKINTILLOCH.—School clinic (£6,000); clerk, Education Authority, Dumbarton.

LITTLEWORTH (Stafford).—St. John's Church; Sir Charles A. Nicholson, architect, London.

LONDON (Becontree, E.).—Hall, Dagenham Avenue; Salvation Army.

LONDON—*continued.*

(East Ham, E.).—Alterations, Coliseum Cinema, Green Street; Scriven & Huxtable.

(Ilford, E.).—Re-erection of portion of factory, Farnham Road, Seven Kings, for the Metropolitan Wire Spring Mattress Co. Extensions, Highways Depôt; borough engineer.

(St. John's Wood, N.W.).—Flats, Circus Road and Grove End Road; Central London Building Co.

(Downham, S.E.).—Additional schools (£41,790), for the London E.C.; Holland & Hannen & Cubitts, Ltd., builders.

(Kennington, S.E.).—Enlargement Beaufoy Institute (£12,000); L.C.C. architect.

(Battersea, S.W.).—Enlargement, Lavender Hill Pavilion; Pavilions, Ltd.

(Clapham, S.W.).—Five blocks of flats, Albion Road; C. Miskin & Son.

(Hammersmith, S.W.).—Central school near Western Avenue; L.C.C. architect.

(Marble Arch, W.).—Enlargement, Marble Arch Pavilion; F. T. Verney, architect, Pavilions, Ltd.

(W.).—Shops, flats, restaurant, &c., adjoining Baker Street Underground Station; Metropolitan Railway Co.

MAIDENHEAD.—Kinema and dance hall, Bridge Street; Maidenhead Picture Theatre, Ltd.

MAIDSTONE (Leeds).—Alterations, with lighting and heating (£100,000), Leeds Castle, for Mr. Wilson-Filmer.

MEXBOROUGH.—Dance hall, shops, and billiard hall, next Palace Kinema; Mexborough Electric Theatre, Ltd.

MIDDLESBROUGH.—Dock and river improvement scheme, for the Tees Commissioners. School clinic, Woodlands Road (£5,500); director of education.

MORLEY.—48 houses, Bradford Road; borough engineer.

NEWPORT (Isle of Wight).—Corn exchange, &c., for the T.C. (£5,000); borough surveyor.

NORTHAMPTON.—Factory extension, Overstone Road; Mounts Factory Co.

PORTSMOUTH.—Workshops for the blind, Portsdown Hill; borough engineer.

RICHMOND (Surrey).—Houses (35), for the T.C.; Streek and Co., Ltd., builders, Tranquil Vale, Blackheath, S.E.

RIPON.—Housing scheme (38); city engineer.

SALE (Cheshire).—Re-erection of factory, for I. & E. Nelson, hosiery manufacturers (several thousand pounds).

SEDGLEY.—Electricity generating station, Redhall Road; Lower Gornal Picture Palace Co.

SOLIHULL.—Extensions, Grammar School; governors.

STIRLINGSHIRE.—New classrooms, laboratory, and gymnasium at Balfron School; clerk, Stirlingshire Education Authority, Stirling. Advanced subjects school at Stirling (£48,000). Additions to five primary schools (£72,545); clerk, Education Authority, Stirling.

STOCKTON-ON-TEES.—Cinema, Norton Avenue, Norton, for Norton Cinema Co., Brandon. Re-housing scheme, Mount Pleasant (£56,000); borough engineer.

STRETFORD.—Alterations, workshops, Empress Street; Empress Coppersmiths & Engineers, Ltd.

SWANSEA (Landore).—Roman Catholic church, Dinas Street; Rev. Father Harrington.

TAIN.—Hall for Parish Church (electric lighting and heating); A. Maitland & Sons, architects.

WALTON-ON-THAMES.—70 houses for U.D.C.; C. B. Carvill.

WARWICK.—Office accommodation, Militia Barracks; Warwickshire C.C.

WEAVERHAM.—School extensions (£4,300), for Cheshire E.C.; F. A. Brown, county architect, Newgate Street, Chester.

WESTON-SUPER-MARE. — Business premises, Meadow Street, for E. J. Steel, draper (several thousand pounds).

WEYMOUTH.—84 houses, Down Close, for Corporation; James Drewitt & Son, Bournemouth.

WHITCHURCH (Salop).—Housing scheme (60), for the U.D.C.; surveyor.

YEOVIL.—Housing scheme (296), for the T.C.; Eadie Towers and Co., Wolverhampton.